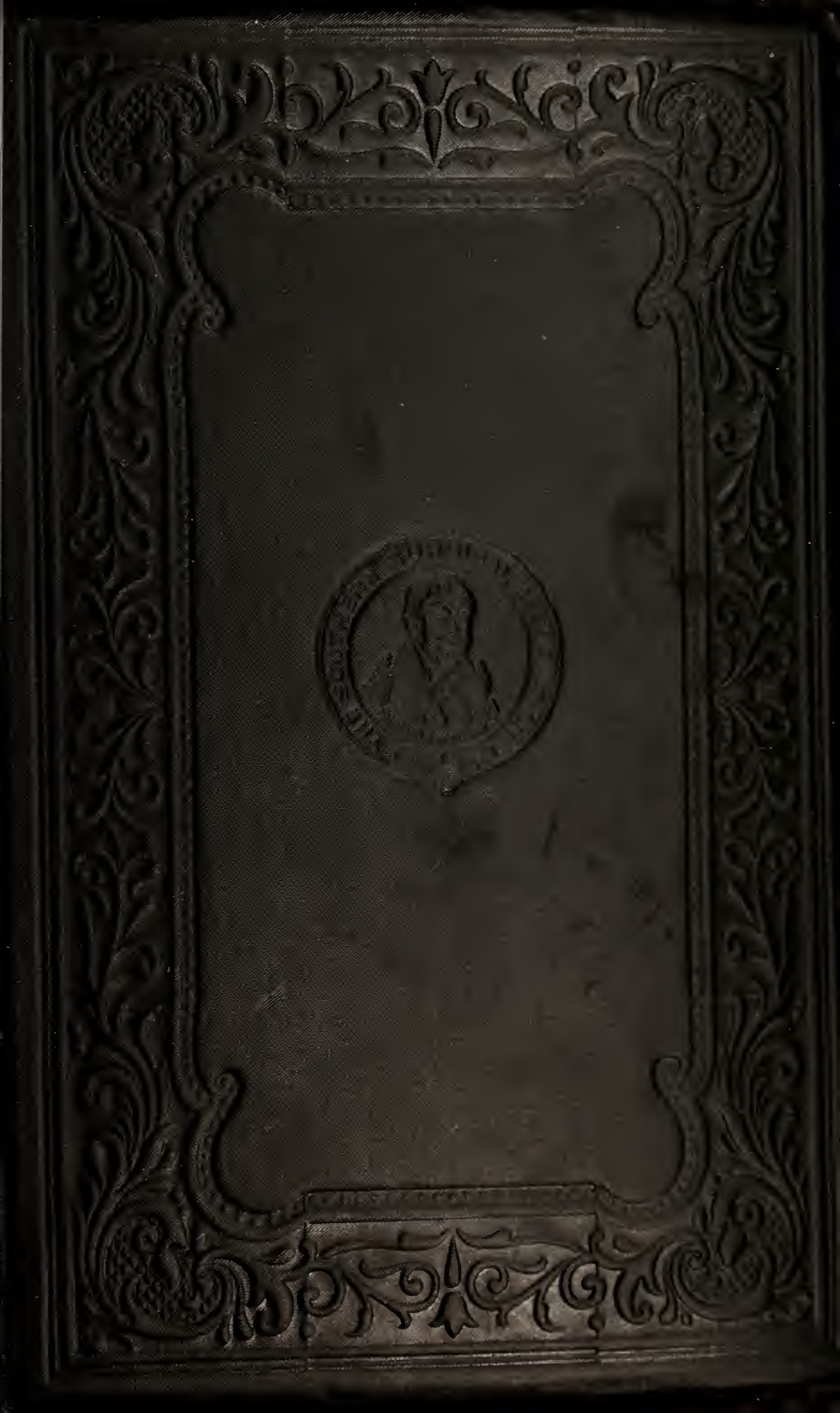

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PUBLISHED BY THE ASSOCIATION

1923

The Association does not hold itself responsible for the views enunciated in the papers and discussions published in this volume.

H. A. ROYSTER, M.D., *Secretary,*
RALEIGH, N. C.

DORNAN, PRINTER
PHILADELPHIA

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OFFICERS FOR 1922–1923

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BATTLE MALONE, Memphis, Tenn.

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RANDOLPH WINSLOW, Baltimore, Md.

C. JEFF MILLER, New Orleans, La.

LIST OF OFFICERS

FROM THE ORGANIZATION TO THE PRESENT TIME.

* Deceased.

	President	*Vice-Presidents*	*Secretary*	*Treasurer*
1888.	*W. D. Haggard	R. D. Webb J. W. Sears	*W. E. B. Davis	Hardin P. Cochrane
1889.	*Hunter H. McGuire	*W. O. Roberts *Bedford Brown	*W. E. B. Davis	Hardin P. Cochrane
1890.	*George J. Engelmann	*Berthold E. Hadra Duncan Eve	*W. E. B. Davis	Hardin P. Cochrane
1891.	Lewis S. McMurtry	*J. McFadden Gaston J. T. Wilson	*W. E. B. Davis	Hardin P. Cochrane
1892.	*J. McFadden Gaston	*Cornelius Kollock *George Ben Johnston	*W. E. B. Davis	Hardin P. Cochrane
1893.	*Bedford Brown	*Joseph Price George A. Baxter	*W. E. B. Davis	Hardin P. Cochrane
1894.	*Cornelius Kollock	A. B. Miles J. B. S. Holmes	*W. E. B. Davis	Hardin P. Cochrane
1895.	*Louis McLane Tiffany	Ernest S. Lewis *Manning Simons	*W. E. B. Davis	*Richard Douglas
1896.	Ernest S. Lewis	*Joseph Taber Johnson *Richard Douglas	*W. E. B. Davis	*A. M. Cartledge
1897.	*George Ben Johnston	W. E. Parker *Floyd W. McRae	*W. E. B. Davis	*A. M. Cartledge
1898.	*Richard Douglas	*H. H. Mudd *James A. Goggans	*W. E. B. Davis	*A. M. Cartledge
1899	*Joseph Taber Johnson	F. W. Parham *W. L. Robinson	*W. E. B. Davis	*A. M. Cartledge
1900.	*A. M. Cartledge	*Manning Simons W. P. Nicolson	*W. E. B. Davis	W. D. Haggard
1901.	*Manning Simons	George H. Noble *L. C. Bosher	W. D. Haggard	*Floyd W. McRae
1902.	*W. E. B. Davis	J. Wesley Bovée J. W. Long	W. D. Haggard	*Floyd W. McRae
1903.	J. Wesley Bovée	*Christopher Tompkins Bacon Saunders	W. D. Haggard	*Floyd W. McRae
1904.	*Floyd W. McRae	George S. Brown J. Shelton Horsley	W. D. Haggard	Charles M. Rosser
1905.	*Lewis C. Bosher	J. D. S. Davis I. S. Stone	W. D. Haggard	Charles M. Rosser
1906.	George H. Noble	Stuart McGuire E. Denegre Martin	W. D. Haggard	Charles M. Rosser
1907.	Howard A. Kelly	Rufus E. Fort Hubert A. Royster	W. D. Haggard	Charles M. Rosser
1908.	F. W. Parham	*Henry D. Fry W. F. Westmoreland	W. D. Haggard	Stuart McGuire
1909.	Stuart McGuire	*John Young Brown R. S. Cathcart	W. D. Haggard	Wm. S. Goldsmith
1910.	*W. O. Roberts	Joseph C. Bloodgood Lewis C. Morris	W. D. Haggard	Wm. S. Goldsmith
1911.	Rudolph Matas	Guy L. Hunner J. Garland Sherrill	W. D. Haggard	Wm. S. Goldsmith
1912.	J. M. T. Finney	J. E. Thompson W. P. Carr	W. D. Haggard	Wm. S. Goldsmith
1913.	*John Young Brown	*Ap Morgan Vance Lomax Gwathmey	W. D. Haggard	Le Grand Guerry
1914.	John W. Long	A. C. Scott James F. Mitchell	W. D. Haggard	Le Grand Guerry
1915.	Bacon Saunders	Thomas S. Cullen S. M. D. Clark	W. D. Haggard	Le Grand Guerry
1916.	Thomas S. Cullen	Robert S. Hill Willard Bartlett	W. D. Haggard	Le Grand Guerry
1917.	W. D. Haggard	J. Ernest Stokes F. R. Hagner	H. A. Royster	Le Grand Guerry
1918.	Isaac S. Stone	Le Grand Guerry Carey P. Rogers	H. A. Royster	Guy L. Hunner
1919.	James E. Thompson	Charles R. Robins George A. Hendon	H. A. Royster	Guy L. Hunner
1920.	Willard Bartlett	C. Jeff Miller Edward G. Jones	H. A. Royster	Guy L. Hunner
1921.	Randolph Winslow	Hugh H. Trout James N. Baker	H. A. Royster	Guy L. Hunner
1922.	C. Jeff Miller	V. P. Blair R. L. Gibbon	H. A. Royster	Guy L. Hunner
1923.	James F. Mitchell	Irvin Abell Battle Malone	H. A. Royster	Urban Maes

LIST OF MEETING PLACES, WITH DATES AND PRESIDING OFFICERS

1888.	Birmingham,	William D. Haggard
1889.	Nashville,	Hunter H. McGuire
1890.	Atlanta,	George J. Engelmann
1891.	Richmond,	Lewis S. McMurtry
1892.	Louisville,	J. McFadden Gaston
1893.	New Orleans,	Bedford Brown
1894.	Charleston,	Cornelius Kollock
1895.	Washington,	Louis McLane Tiffany
1896.	Nashville,	Ernest S. Lewis
1897.	St. Louis,	George Ben Johnston
1898.	Memphis,	Richard Douglas
1899.	New Orleans,	Joseph Taber Johnson
1900.	Atlanta,	A. M. Cartledge
1901.	Richmond,	Manning Simons
1902.	Cincinnati,	W. E. B. Davis
1903.	Atlanta,	J. Wesley Bovée
1904.	Birmingham,	Floyd W. McRae
1905.	Louisville,	Lewis C. Bosher
1906.	Baltimore,	George H. Noble
1907.	New Orleans,	Howard A. Kelly
1908.	St. Louis,	F. W. Parham
1909.	Hot Springs,	Stuart McGuire
1910.	Nashville,	William O. Roberts
1911.	Washington,	Rudolph Matas
1912.	Old Point,	John M. T. Finney
1913.	Atlanta,	John Young Brown
1914.	Asheville,	John W. Long
1915.	Cincinnati,	Bacon Saunders
1916.	White Sulphur Springs,	Thomas S. Cullen
1917.	St. Augustine,	William D. Haggard
1918.	Baltimore,	Isaac S. Stone
1919.	New Orleans,	James E. Thompson
1920.	Hot Springs,	Willard Bartlett
1921.	Pinehurst,	Randolph Winslow
1922.	Memphis,	C. Jeff Miller

HONORARY FELLOWS

Founder.—Davis, John D. S.	Birmingham, Ala.
1894.—Foy, George	Dublin.
1894.—Jacobs, Charles	Brussels.
1910.—Jones, Robert	Liverpool.
1910.—Lane, Arbuthnot	London.
1917.—Lewis, Ernest S.	New Orleans, La.
Founder.—Long, John Wesley	Greensboro N. C.
1917.—McMurtry, Lewis S.	Louisville, Ky.
1894.—Martin, A.	Berlin.
1894.—Morisani, O.	Naples.
1910.—Morison, Rutherford	New-Castle-on-Tyne
1910.—Moynihan, B. G. A.	Leeds.
1910.—Myles, Thomas, Sir	Dublin.
1910.—Robson, Mayo	London.
1910.—Stiles, H. J.	Edinburgh.
Founder.—Stone, Isaac S.	Washington, D. C.
1920.—Vander Veer, Albert	Albany, N. Y.

SENIOR FELLOWS

1922.—Porter, Miles F.	Fort Wayne, Ind.
1922.—Reed, C. A. L.	Cincinnati, O.
1922.—Simpson, Frank F.	Pittsburgh, Pa.
1922.—Young, Hugh H.	Baltimore, Md.

FELLOWS

1908.—Abell, Irvin, M.D. Professor of Principles and Practice of Surgery and Clinical Surgery, Medical Department, University of Louisville; Visiting Surgeon, Louisville City Hospital; President of Staff, St. Joseph's Infirmary; Consultant to Staff, Children's Free Hospital. *Vice-President.* 700 Francis Building, Louisville, Ky.

1911.—Allen, Carroll W., M.D. 43 Audubon Boulevard, New Orleans, La.

1921.—Allison, Nathaniel, M.D. Dean and Professor of Clinical Orthopedic Surgery, Washington University Medical School; Surgeon to the St. Louis Children's Hospital, Barnes Hospital, and St. Luke's Hospital. 608 Humboldt Building, St. Louis, Mo.

1915.—Baer, William Stevenson, A.B., M.D. Associate Professor of Clinical Orthopedic Surgery, Johns Hopkins University; Associate in Orthopedic Surgery in charge of Orthopedic Department, Johns Hopkins Hospital; Consulting Orthopedic Surgeon, Home for Incurables; Surgeon-in-chief, Children's Hospital; Visiting Orthopedic Surgeon, Union Protestant Infirmary, Hospital for Women of Maryland, and Robert Garrett Hospital for Children; Consulting Orthopedic Surgeon, Cambridge Hospital, Cambridge, Md., and Sheppard and Enoch Pratt Hospital, Towson, Md. 4 East Madison Street, Baltimore, Md.

1917.—Bagley, Charles, Jr., A.B., M.D. Associate in Experimental Neurology Johns Hopkins University. The Latrobe, Baltimore, Md.

1914.—Bailey, Fred. Warren, B.S., M.D. Associate Professor of Surgery, St. Louis University School of Medicine; Surgeon, St. John's Hospital; Visiting Surgeon, St. Louis City Hospital; Consulting Surgeon, American Car and Foundry Co. 611 Metropolitan Building, St. Louis, Mo.

1905.—Baker, James Norment, M.D. Attending Surgeon, Highland Park Sanitarium; Local Surgeon, A. C. L. Railroad. *Vice-President,* 1921. 602 S. Perry Street, Montgomery, Alabama.

1916.—Balfour, Donald Church, M.D. Surgeon to St. Mary's Hospital. Rochester, Minn.

1916.—Barksdale, John W., M.D. Winona, Miss.

1908.—Barr, Richard Alexander, M.D. Professor of Surgery and Clinical Surgery, Medical Department of Vanderbilt University; Major and Surgeon of First Tennessee Infantry, U. S. A., Spanish American War and Phillipine Insurrection; Late Lieut.-Col., M.C., U. S. A. (Hospital Unit "S"). 800 Nineteenth Avenue, S., Nashville, Tenn.

1905.—Barrow, David, M.D. Ex-President Kentucky State Medical Society. 148 Market Street, Lexington, Ky.

1922.—Barrow, D. Woolfolk, M.D. Attending Surgeon, St. Joseph's Hospital; Consulting Surgeon, Good Samaritan Hospital. 190 N. Upper Street, Lexington, Ky.

1905.—Bartlett, Willard, A.B., A.M., M.D. Associate in Clinical Surgery, Washington University; Demonstrator of Pathological Anatomy, University of Berlin, 1896–97; Voluntary Assistant, University of Strassburg, 1897–98; Professor of Pathology, Marion-Sims College of Medicine, 1898–1901; Demonstrator and Professor of Experimental Surgery, Washington University Medical School, 1901–12; Chairman of the Surgical Staff, St. Louis City Hospital, 1910–12; Surgeon, Missouri Baptist Sanitarium. *Vice-President*, 1916; *President*, 1920. 410 Metropolitan Building, St. Louis, Mo.

1901.—Baughman, Greer, M.D. Professor of Obstetrics, Medical College of Virginia; Visiting Obstetrician to the Virginia Hospital, Memorial Hospital, and Stuart Circle Hospital. 26 North Laurel Street, Richmond, Virginia.

1920.—Beall, Frank Cooke, B.S., M.D. Surgeon-in-Charge, the Johnson-Beall Hospital. 703 Lamar Street, Fort Worth, Texas.

1917.—Bell, Richard Phillips, B.A., M.D. Chief of Staff, King's Daughters Hospital. 202 Professional Building, Staunton, Va.

1916.—Biggs, Montgomery Herman, M.D. Surgeon to Rutherford Hospital; Chief Surgeon C. C. and O. Railway. Rutherfordton, N. C.

1916.—Black, William T., M.D. Associate Professor of Gynecology, University of Tennessee; Visiting Gynecologist to St. Joseph's and Baptist Memorial Hospitals; Associate Visiting Gynecologist, Memphis General Hospital; President of Staff and Visiting Surgeon, Porter Home and Leath Orphan Asylum. Exchange Building, Memphis, Tenn.

1908.—Blair, Vilray Papin, A.M., M.D. *Vice-President*, 1922. Metropolitan Building, St. Louis, Mo.

1906.—Bloodgood, Joseph Colt, M.D. Associate Professor of Surgery, Johns Hopkins University; Associate Surgeon, Johns Hopkins Hospital; Surgeon to the Union Protestant Infirmary; Chief Surgeon to St. Agnes' Hospital. *Vice-President*, 1910. 904 North Charles Street, Baltimore, Md.

1920.—Boland, Frank Kells, A.B., M.D. Professor of Surgery, Emory University; Surgeon to the Grady, the Wesley Memorial, and the Georgia Baptist Hospitals; Piedmont Sanatorium; Davis-Fischer Sanatorium. 436 Peachtree Street, Atlanta, Ga.

1901.—Boldt, Hermann J., M.D. Consulting Gynecologist to Post-Graduate Hospital, Beth Israel Hospital, Stuyvesant Polyclinic, Union Hospital, and St. Vincent's Hospital; Professor Emeritus of Gynecology, Post-Graduate Medical School and Hospital; Honorary Fellow of the American Gynecological Society; Member of the Gynecological Society of Germany; Fellow of the Royal Society of Medicine (London); ex-President of the New York Obstetrical Society; of the German Medical Society of New York; of the Section of Obstetrics and Gynecology of the New York Academy of Medicine. 616 Madison Avenue, New York, N. Y.

1902.—Bonifield, Charles Lybrand, M.D. Professor of Gynecology, Medical Department University of Cincinnati; Member and ex-President, American Association of Obstetricians and Gynecologists; ex-President, Cincinnati Academy of Medicine; ex-President, Cincinnati Obstetrical Society; ex-President, Ohio State Medical Association. 409 Broadway, Cincinnati, Ohio.

1895.—Bovée, J. Wesley, M.D. Fellow and ex-President American Gynecological Society; President of Washington Obstetrical and Gynecological Society; ex-President Medical and Surgical Society of the District of Columbia; Honorary Fellow of Medical Society of Virginia; ex-Chairman of the Section of Gynecology, American Medical Association; Professor of Gynecology, George Washington University; Gynecologist to Columbia, and George Washington University Hospitals; Attending Gynecologist to St. Elizabeth's Hospital for the Insane, Washington, D. C.; President, Medical Board, Woman's Welfare Association; Medical Member, Board of Trustees of the National Training School for Girls. *Vice-President*, 1902; *President*, 1903. The Rochambeau, Washington, D. C.

1908.—Bryan, Robert C., M.D. Professor of Genito-urinary Diseases, Medical College of Virginia; Visiting Surgeon to the Grace, the Memorial, and the Virginia Hospitals. Grace Hospital, Richmond, Virginia.

1910.—Bryan, W. A., M.D. Professor of Surgery and Clinical Surgery, Vanderbilt University; Professor of Oral Surgery, Dental Department, Vanderbilt University; Surgeon, Woman's Hospital, Nashville City Hospital, and Watauga Sanitarium. 146 Eighth Avenue, N., Nashville, Tenn.

1913.—Buist, A. Johnston, M.D. Professor of Gynecology, Medical College of the State of South Caroline; Visiting Gynecologist, Roper Hospital. 279 Meeting Street, Charleston, S. C.

1907.—Burch, Lucius E., M.D. Acting Dean and Professor of Gynecology, School of Medicine, Vanderbilt University; Gynecologist, Woman's Hospital and Vanderbilt University Hospital; Chief Surgeon, Tennessee Central Railroad; late Lieut.-Col., M.C., U. S. Army, A. E. F. 210 Doctor's Building, Nashville, Tenn.

1917.—Burnam, Curtis Field, A.B., M.D. Surgeon, Howard A. Kelly Hospital. 1418 Eutaw Place, Baltimore, Md.

1902.—Caldwell, C. E., A.M., M.D. Professor of Clinical Surgery and Surgical Anatomy in Medical Department, University of Cincinnati; Surgeon to Cincinnati General Hospital. "The Livingston," Seventh and Race Streets, Cincinnati, Ohio.

1910.—Caldwell, Robert, M.D. Professor of Surgical Anatomy, Vanderbilt University; Surgeon to St. Thomas' Hospital. 510 Jackson Building, Nashville, Tenn.

1906.—Cannaday, John Egerton, M.D. Visiting Surgeon, Charleston General, and St. Francis Hospitals. Kanawha Banking and Trust Co. Building, Charleston, W. Va.

1904.—Carothers, Robert, M.D. Surgeon to the Good Samaritan and Children's Hospitals. 409 Broadway, Cincinnati, Ohio.

1899.—Cathcart, R. S., M.D. Professor of Abdominal Surgery, Medical College of the State of South Carolina; Surgeon-in-chief, Roper Hospital, Charleston, S. C.; Surgeon, Atlantic Coast Line Railway, Charleston Consolidated Railway and Lighting Co., The Citadel—the Military College of South Carolina, and the Confederate Home College, Charleston, S. C. *Vice-President*, 1909. 75 Hasell Street, Charleston, South Carolina.

1907.—Clark, John G., M.D. Professor of Gynecology, University of Pennsylvania; Gynecologist-in-Chief, University Hospital. 2017 Walnut Street, Philadelphia, Penna.

1907.—Clark, S. M. D., M.D. Professor of Gynecology and Clinical Obstetrics, Tulane Medical Department; Visiting Surgeon, Charity Hospital. 1435 Harmony Street, New Orleans Louisiana.

1919.—Clopton, Malvern Bryan, M.D. Associate in Surgery, Washington University Medical School; Visiting Surgeon, St. Luke's Hospital; Associate Surgeon, Barnes Hospital and Children's Hospital. Humboldt Building, St. Louis, Missouri.

1893.—Cocram, Henry S., M.D. 108 Baronne Street, New Orleans, La.

1908.—Coffey, Robert C., M.D. Secretary, Oregon State Board of Medical Examiners; Councillor, Oregon State Medical Association. Stevens Building, Portland, Oregon.

1922.—Cohn, Isidore, B.S., M.D. Associate Senior Surgeon, Touro Infirmary; Professor of Clinical Surgery, Tulane University. 1522 Aline Street, New Orleans, La.

1909.—Cole, Herbert Phalon, M.D. Van Antwerp Building, Mobile, Ala.

1916.—Coleman, Claude C., M.D. Professor of Oral Surgery and Anesthesia; Associate Professor in Operative Surgery, Medical College of Virginia; Attending Surgeon, Hospital Division, Medical College of Virginia. 503 Professional Building, Richmond, Va.

1902.—Coley, William B., M.D. Professor of Clinical Cancer Research, Cornell University Medical College; Attending Surgeon to Hospital for Ruptured and Crippled, and Memorial Hospital. 6 West Fiftieth Street, New York, N. Y.

1914.—Cousins, William Lewis, M.D. Surgeon-in-Chief, St. Barnabas' Hospital; Consulting Surgeon, Maine General Hospital. 231 Woodford Street, Portland, Maine.

1916.—Cowden, Charles N., M.D. Surgeon to City Hospital; Gynecologist to St. Thomas' Hospital. Hitchcock Bldg., Nashville, Tenn.

1907.—Crawford, Walter W., M.D. Ex-President, Southern Medical Association; ex-President, Mississippi State Medical Association; Surgeon to South Mississippi Infirmary; Lieut.-Col., M.C., U. S. Army; Chief Surgical Service, Base Hospital, Camp Shelby, 1917–18; Chief Surgical Service, Base Hospital 79, 1918–19. Hattiesburg, Miss.

1902.—Crile, George W., M.D. Professor of Surgery, The School of Medicine of Western Reserve University; Visiting Surgeon to Lakeside Hospital. 1021 Prospect Avenue, Cleveland, Ohio.

1908.—Crisler, Joseph Augustus, B.S., M.D. Exchange Building, Memphis, Tenn.

1920.—Crook, Jere Lawrence, A.M., M.D. Owner and Chief Surgeon of the Crook Sanitarium; President of the Southern Medical Association (1921); Division Surgeon of the Illinois Central Railroad; Local Surgeon of the N. C. and St. L., and G. M. & N. Railroads; Surgeon for U. S. Government in the Marine Hospital Service. 110 W. Baltimore Street, Jackson, Tenn.

1922.—Cubbins, William R., B.S., M.D. Professor of Surgery, Northwestern University; Chief of Surgical Staff, Cook County Hospital; Surgeon to Wesley Memorial Hospital. 29 East Madison Street, Chicago, Ill.

1906.—Cullen, Thomas Stephen, M.B. Professor of Clinical Gynecology, Johns Hopkins University; Visiting Gynecologist, Johns Hopkins Hospital; Consultant in Abdominal Surgery, Church Home and Infirmary; Fellow of the American Gynecological Society; Honorary Member to La Societa Italiana Ostettricia Ginecologia, Rome; Corresponding Member of the Gesellschaft f. Geburtshülfe, Leipzig; Honorary Fellow of the Edinburgh Obstetrical Society. *Vice-President*, 1915; *President*, 1916. 20 E. Eager Street, Baltimore, Maryland.

1922.—Culpepper, James H., M.D. Assistant Surgeon, Sarah Leigh Hospital and Sarah Leigh Clinic. 109 College Place, Norfolk, Va.

1907.—Danna, Joseph A., M.D. Chief Visiting Surgeon, Charity Hospital. Charity Hospital, New Orleans, Louisiana.

1910.—Davis, John Staige, M.D. Associate in Clinical Surgery, Johns Hopkins University; Assistant Visiting and Dispensary Surgeon, Johns Hopkins Hospital; Visiting and Plastic Surgeon to the Union Memorial Hospital, the Hospital for the Women of Maryland, and the Children's Hospital of Baltimore. The Severn, Baltimore, Md.

1900.—Deaver, John B., M.D. Surgeon-in-Chief to the Lankenau Hospital; John Rhea Barton Professor of Surgery, University of Pennsylvania; Surgeon to the Hospital of the University of Pennsylvania. 1634 Walnut Street, Philadelphia.

1921.—Dixon, W. C., M.D. Gynecologist to the Nashville City Hospital, Vanderbilt University Hospital, and St. Thomas' Hospital; Associate Professor of Gynecology in the Medical Department of Vanderbilt University. 216 Doctors' Building, Nashville, Tenn.

1921.—Dowman, Charles Edward, A.B., M.D. Assistant Professor of Surgery, in charge of Neurological Surgery, Medical Department of Emory University; Attending Surgeon, Wesley Memorial Hospital; Attending Neurological Surgeon, Grady Memorial Hospital, Colored Division; Attending Neurological Surgeon, Scottish Rite Hospital for Crippled Children; Attending Neurological Surgeon, Georgia Baptist Hospital; Attending Neurological Surgeon, Piedmont Sanatorium; Attending Neurological Surgeon, Davis-Fischer Sanatorium. 78 Forrest Avenue, Atlanta, Ga.

1914.—Downes, William Augustus, M.D. Assistant Professor of Clinical Surgery, Columbia University, College of Physicans and Surgeons; Attending Surgeon, St. Luke's, Memorial and Babies' Hospitals; Consulting Surgeon, Manhattan State Hospital, Hospital for Ruptured and Crippled, New York, Infirmary for Women and Children, New York, United Hospital, Port Chester. 424 Park Avenue, New York, N. Y.

1916.—Du Bose, Francis Goodwin, M.D. Surgeon-in-Charge of Vaughan Memorial Hospital. Selma, Ala.

1907.—Elbrecht, O. H., M.D. Visiting Surgeon, St. Louis City Hospital; Consulting Surgeon to St. Louis Maternity, Bethesda and Missouri Pacific Railroad Hospitals. 423 Metropolitan Building, St. Louis, Mo.

1891.—Elkin, William Simpson, M.D. Dean and Professor of Gynecology in the School of Medicine, Emory University; ex-President of the Atlanta Society of Medicine; Consulting Surgeon to Grady Hospital; Gynecologist to Wesley Memorial Hospital. 1029 Candler Building, Atlanta, Ga.

1922.—Farmer, Charles, M.D. Adjunct Professor of Gynecology and Abdominal Surgery, Medical Department University of Louisville; Surgeon to the Louisville City Hospital and John N. Norton Memorial Infirmary. 1110 Francis Building, Louisville, Kentucky.

1904.—Finney, J. M. T., M.D. Associate Professor of Surgery, Johns Hopkins University; Surgeon to Out-patients, Johns Hopkins Hospital. *President*, 1912. 1300 Eutaw Place, Baltimore, Md.

1920.—Fisher, William Alexander, Jr., M.D. Associate in Clinical Surgery, Johns Hopkins University; Assistant Visiting Surgeon, Johns Hopkins Hospital; Visiting Surgeon, Union Memorial Hospital, Church Home and Infirmary, Hospital for the Women of Maryland, Children's Hospital School. 715 Park Avenue, Baltimore, Md.

1905.—Frank, Louis, M.D. Professor of Surgery and Clinical Surgery, University of Louisville; Surgeon to Louisville City Hospital; Surgeon, Norton Memorial Infirmary; Consulting Surgeon, Children's Free Hospital. 400 Atherton Building, Louisville, Ky.

1916.—Frazier, Charles H., M.D. Professor of Clinical Surgery, University of Pennsylvania. 1724 Spruce Street, Philadelphia, Pa.

1917.—Gerster, John C. A., M.D. Assistant Professor of Clinical Surgery, Cornell University Medical College. 18 East 78th Street, New York, N. Y.

1917.—Gessner, Hermann B., A.M., M.D. Professor of Operative and Clinical Surgery in Tulane University; Chief Visiting Surgeon to Charity Hospital; Junior Surgeon to Touro Infirmary. 1105 Maison Blanche, New Orleans, La.

1920.—Gibbon, John H., M.D. Professor of Surgery, Jefferson Medical College; Surgeon to the Pennsylvania and Jefferson Hospitals; Consulting Surgeon, Bryn Mawr Hospital; Col., Medical Reserve Corps, U. S. A. 1608 Spruce Street, Philadelphia, Pa.

1913.—Gibbon, Robert L., M.D. *Vice-President*, 1922. Charlotte, N. C.

1918.—Gilcreest, Edgar L., A.B., M.D. 3698 California St., San Francisco, Cal.

1900.—Goldsmith, W. S., M.D. *Treasurer*, 1909–1912. 262 Jackson Street, Atlanta, Ga.

1922.—Griffith, F. Webb, A.B., A.M., M.D. Surgeon to Asheville Mission Hospital, Asheville, N. C. and to Biltmore Hospital, Biltmore, N. C.; Member of Visiting Staff, State Hospital, Morganton, N. C. Haywood Building, Asheville, N. C.

1905.—Guerry, Le Grand, M.D. Surgeon, Columbia Hospital. *Treasurer*, 1913–1918. *Vice-President*, 1918. Columbia, S. C.

1922.—Guthrie, Donald, Ph.B., M.D. Surgeon to Robert Packer Hospital. Sayre, Pa.

1896.—Gwathmey, Lomax, M.D. Attending Surgeon, Norfolk Protestant Hospital, Out-patient Department; Consulting Surgeon, Parish Memorial and U. S. P. H. Hospitals; Co-proprietor, St. Christopher's Hospital. *Vice-President*, 1913. Norfolk, Va.

1896.—Haggard, William David, M.D. Professor of Surgery and Clinical Surgery, Vanderbilt University; Surgeon to St. Thomas' Hospital. *Treasurer*, 1900; *Secretary*, 1901–1916; *President*, 1917. 706 Church Street, Nashville, Tenn.

1910.—Hagner, Francis Randall, M.D. Professor of Genito-urinary Surgery, George Washington University; Attending Genito-urinary Surgeon, George Washington University Hospital; Attending Surgeon, Garfield Memorial Hospital. *Vice-President*, 1917. The Farragut, Washington, D. C.

1892.—Hall, Rufus Bartlett, A.M., M.D. Emeritus Professor of Gynecology and Clinical Gynecology, Ohio-Miami Medical College, Medical Department, University of Cincinnati; Surgeon-in-Charge of the Hall Hospital; ex-President of the American Association of Obstetricians and Gynecologists; ex-President of the Ohio State Medical Society; Member of the British Medical Society; ex-President of the Cincinnati Academy of Medicine; ex-President of the Cincinnati Obstetrical Society; Member of the American Medical Association. 628 Elm Street, Cincinnati, Ohio.

1910.—Hanes, Granville S., M.D. Professor of Diseases of the Rectum, Medical Department of the University of Louisville; Surgeon to the Louisville Public Hospital, John N. Norton Memorial Infirmary. Francis Building, Louisville, Ky.

1896.—Heflin, Wyatt, M.D. Gynecologist to the Hillman Hospital; Member of Surgical Staff of South Highlands Infirmary 3216 Cliff Road, Birmingham, Ala.

1917.—Helms, John Sullivan, A.B., M.D. Chief of Staff and Director Division of Surgery, the Bayside Hospital; Chief Surgeon, Tampa Children's Home; Consulting Surgeon, Gordon Keller Memorial Hospital. Tampa, Fla.

1905.—Hendon, George A., M.D. Professor of Surgery and Clinical Surgery, University of Louisville; Surgeon, St. Anthony's Hospital, Louisville City Hospital. *Vice-President*, 1919. 546 Francis Building, Louisville, Ky.

1918.—Henson, James W., M.D. Associate Professor of Surgery, Medical College of Virginia; Member of Surgical Staff of Virginia and Memorial Hospitals; Surgeon to the Southern Railway. 405 N. Allen Avenue, Richmond, Va.

1922.—Heuer, George J., B.S., M.D. Professor of Surgery, University of Cincinnati Medical College; Director of Surgery, Cincinnati General Hospital. Cincinnati General Hospital, Cincinnati, Ohio.

1889.—Hill, Robert Somerville, M.D. Surgeon to the Laura Hill Hospital; Life Councillor, Medical Association of the State of Alabama; Member of the Alabama State Board of Health; ex-President of the Montgomery County Medical Association; former Surgeon of the Second Regiment, Alabama State Militia. *Vice-President*, 1916. Montgomery, Ala.

1913.—Hodgson, Fred G., M.D. Professor of Orthopedic Surgery, Medical Department, Emory University; Orthopedic Surgeon to Grady, Wesley Memorial, Georgia Baptist, and Mac Vicar Hospitals. 746 Peachtree Street, Atlanta, Ga.

1911.—Hogan, Edgar P., M.D. Associate Professor of Gynecology and Abdominal Surgery, Graduate School of Medicine of the University of Alabama; Resident Surgeon and Gynecologist to the Hillman Hospital. 412–14 Empire Building, Birmingham, Ala.

1906.—Holden, Gerry R., M.D. Formerly House Surgeon, Roosevelt Hospital, New York City; formerly Resident Gynecologist, Johns Hopkins Hospital, and Assistant in Gynecology, Johns Hopkins Medical School. 513 Laura Street, Jacksonville, Fla.

1900.—Horsley, John Shelton, M.D. Surgeon-in-Charge, St. Elizabeth's Hospital. *Vice-President*, 1904. 617 West Grace Street, Richmond, Va.

1921.—Hupp, Frank Le Moyne, A.M., M.D. Attending Surgeon to Ohio Valley General Hospital; Consulting Surgeon to Reynolds Memorial Hospital, Glendale and to Sheltering Arms Hospital, Hansford. 61 Fourteenth Street, Wheeling, W. Va.

1903.—Hunner, Guy Le Roy, M.D. Associate in Gynecology, Johns Hopkins University; Consulting Gynecologist; Frederick City Hospital, Frederick, Md., and Hagerstown Hospital, Hagerstown, Md.; Visiting Gynecologist, the Johns Hopkins Hospital, Church Home, Hebrew Hospital, Hospital for the Women of Maryland, and Union Memorial Hospital. *Vice-President*, 1911. *Treasurer*, 1918–1923. 2305 St. Paul Street, Baltimore, Md.

1900.—Ill, Edward Joseph, M.D. Gynecologist and Medical Director Emeritus, St. Michael's Hospital; Gynecologist

and Supervising Obstetrician Emeritus, Hospital of St. Barnabas; Consulting Gynecologist, Newark Beth Israel Hospital, Newark City, Newark Memorial, and St. James Hospitals, Newark; Mountainside Hospital, Montclair; St. Elizabeth's Hospital, Elizabeth; Somerset Hospital, Somerville; Muhlenberg Hospital, Plainfield; Perth Amboy City Hospital, Perth Amboy; Stumpf Memorial Hospital, Kearney; All Souls' and Morristown Hospitals, Morristown; New Jersey State Village for Epileptics, Skillman. 1002 Broad Street, Newark, N. J.

1908.—Jonas, Ernst, M.D. Clinical Professor of Surgery, Medical Department, Washington University; Chief of Surgical Clinic, Washington University Hospital; Gynecologist to the Jewish Hospital; Surgeon to the Martha Parsons Hospital for Children; Fellow of the American Association of Obstetricians and Gynecologists. 4495 Westminster Place, St. Louis, Missouri.

1922.—Jones, Daniel F., A.B., M.D. Instructor in Surgery, Harvard Medical School; Visiting Surgeon to the Massachusetts General Hospital; Consulting Surgeon to the New England Hospital for Women and Children and Beth Israel Hospital, Boston; Union Hospital, Fall River; Brockton Hospital, Brockton; Addison Gilbert Hospital, Gloucester; Sturdy Memorial Hospital, Attleboro; and Eastern Maine General Hospital, Bangor, Maine. 195 Beacon Street, Boston, Mass.

1902.—Jordan, William Mudd, M.D. 915 Empire Building, Birmingham, Ala.

1912.—Judd, Edward Starr, M.D. Surgeon to Mayo Clinic, Rochester, Minn.

1890.—Kelly, Howard Atwood, M.D. Founder of Kensington Hospital, Philadelphia; Associate Professor of Obstetrics, University of Pennsylvania, 1888–89; Professor of Gynecology and Obstetrics, Johns Hopkins University, 1889–99; Emeritus Professor of Gynecology, Johns Hopkins University; Consulting Gynecologist to Johns Hopkins Hospital; Membre Associé Etranger de la Société Obstétricale et Gynécologique de Paris; Correspondirendes Mitglied der Gesellschaft f. Geburtshülfe zu Leipzig; Honorary Fellow, Edinburgh Obstetrical Society, Royal Academy of Medicine (Ireland), and British Gynecological Society; Member of Washington Academy of Sciences; Fellow of the American Gynecological Society; Commander of the Order of Leopold II (1920). *President*, 1907. 1418 Eutaw Place, Baltimore, Maryland.

1917.—Kerr, Harry Hyland, M.D., C.M. Clinical Professor of Surgery, George Washington University Medical School; Attending Surgeon Garfield Memorial and Children's Hospitals; Consulting Surgeon, Providence Hospital. 1742 N. Street, N. W., Washington, D. C.

1907.—Kirchner, Walter C. G., M.D. Formerly Surgeon-in-Charge, St. Louis City Hospital; Visiting Surgeon, City Hospital; Consulting Surgeon, St. John's Hospital. Metropolitan Building, 508 N. Grand Avenue, St. Louis, Mo.

1914.—Landry, Lucian H., M.D. Demonstrator of Operative Surgery and Assistant Professor of Clinical Surgery, Tulane University of Louisiana, School of Medicine; Senior Associate in Surgery, Touro Infirmary; Visiting Surgeon, Charity Hospital. 2255 St. Charles Avenue, New Orleans, La.

1913.—LaRoque, G. Paul, M.D. Associate Professor of Surgery, Medical College of Virginia; Surgeon, Memorial Retreat, Dooley, St. Philip, Virginia, and Sheltering Arms Hospitals. 603 East Grace Street, Richmond, Va.

1916.—Law, Arthur Ayer, M.D. Associate Professor of Surgery, University of Minnesota Medical School and Mayo Foundation; Lieut.-Col., M.C., U. S. Army, Commanding Base Hospital No. 26 in A. E. F.; Surgeon, University of Minnesota Hospital and University Hospital; Assistant Chief of University Hospital. Syndicate Building, Minneapolis, Minn.

1917.—Ledbetter, Samuel L., Jr., M.D. Visiting Surgeon. St. Vincent's Hospital; Associate Surgeon, Hillman Hospital, 516 Empire Building, Birmingham, Ala.

1894.—Leigh, Southgate, M.D. Surgeon and Gynecologist, Sarah Leigh Hospital and Clinic; Chief Surgeon, Virginian Railway Co.; Consulting Surgeon, S. A. L. Railway; Surgeon, N. & W., Penn., C. & O. and A. C. L. Railways; ex-President, Norfolk County Medical Society, Medical Society of Virginia; Tri-State Medical Association, Seaboard Medical Association, A. C. L. Railway Surgeons' Association, N. & W. Railway Surgeons Association, C. & O. Railway Surgeons Association, Southern States Association Railway Surgeons. 109 College Place, Norfolk, Va.

1912.—Lewis, Bransford, M.D. Century Building, St. Louis, Mo.

1914.—Lewis, Dean, A.B., M.D. Professor of Surgery, Rush Medical College; Attending Surgeon, Presbyterian Hospital; Consulting Surgeon, Anne W. Durand Hospital. 122 South Michigan Avenue, Chicago, Ill.

1900.—Lloyd, Samuel, M.D. Emeritus Professor of Surgery, New York Post-Graduate Medical School; Attending Surgeon to the Lutheran Hospital; Consulting Surgeon to the Post-Graduate Hospital, St. Francis Hospital, Italian Hospital, St. Mary's Hospital (Orange, N. J.), St. Francis Hospital, (Poughkeepsie, N. Y.) and to the Benedictine Sanitarium, (Kingston, N. Y.) 50 East Forty-second Street, New York, N. Y.

1921.—Lower, William Edgar, M.D. Associate Surgeon, Lakeside Hospital; Visiting Surgeon, Luthern Hospital; Director of Surgery, Mt. Sinai Hospital; Associate Professor of Surgery, Western Reserve University. Euclid Avenue at Ninety-third Street, Cleveland, Ohio.

1904.—Lupton, Frank A., M.D. 816 Woodward Building, Birmingham, Ala.

1902.—McAdory, Wellington P., M.D. Surgeon to Hillman Hospital. Birmingham, Ala.

1922.—McGehee, John L., A.B., M.D. Associate Professor of Surgery, College of Medicine, University of Tennessee; Visiting Surgeon, Memphis General Hospital, Methodist Hospital and Baptist Memorial Hospital. 1705 Central Bank Building, Memphis, Tenn.

1911.—McGlannan, Alexius, M.D. Professor of Surgery, University of Maryland, and College of Physicians and Surgeons, Baltimore. 115 West Franklin Street, Baltimore, Md.

1893.—McGuire, Stuart, M.D. Professor of Surgery, Medical College of Virginia; Surgeon-in-Charge, St. Luke's Hospital; Visiting Surgeon to the Memorial and Allied Hospitals. *Vice-President*, 1906; *Treasurer*, 1908; *President*, 1909. 513 East Grace Street, Richmond, Va.

1905.—MacLean, Henry Stuart, M.D. Surgeon, Grace Hospital; Visiting Surgeon, Memorial Hospital. 401 West Grace Street, Richmond, Va.

1915.—Maes, Urban, M.D. Professor of Clinical and Operative Surgery, School of Medicine, Tulane University of Louisiana; Visiting Surgeon, Charity Hospital; Senior Associate in Surgery, Touro Infirmary; Surgical Consultant, United States Marine Hospital, New Orleans. *Treasurer*. 1671 Octavia Street, New Orleans, La.

1912.—Malone, Battle, M.D., *Vice-President*. 624 Exchange Building, Memphis, Tenn.

1891.—Marcy, Henry Orlando, A.M., M.D., LL.D. Surgeon to the Private Hospital for Women, Cambridge; ex-President of the American Medical Association; President of the Section on Gynecology, Ninth International Medical Congress; late President of the American Academy of Medicine; Member of the British Medical Association, Massachusetts Medical Society, Boston Gynecological Society; Fellow of the American College of Surgeons; Corresponding Member of the Medico-Chirurgical Society of Bologna, Italy; late Surgeon, U. S. A. 180 Commonwealth Avenue, Boston, Mass.

1899.—Martin, E. Denegre, M.D. Professor of Surgery, Post-Graduate Department, Tulane Medical College; Visiting Surgeon to Charity Hospital. *Vice-President*, 1906. 3513 Prytania Street, New Orleans, La.

1913.—Martin, Franklin H., M.D. Professor of Gynecology, Post-Graduate School; Consulting Staff, St. Luke's Hospital. Editor, *Surgery, Gynecology and Obstetrics*. 30 North Michigan Avenue, Chicago, Ill.

1904.—Mason, J. M., M.D. Gynecologist to St. Vincent's Hospital; Surgeon to Hillman Hospital. 1915 Sixteenth Avenue, S., Birmingham, Ala.

1899.—Mastin, William M., M.D. Fellow of the American Surgical Association; Member of the American Association of Genito-urinary Surgeons; Surgeon to the Mobile City Hospital. Joachim and Conti Streets, Mobile, Ala.

1893.—Matas, Rudolph, M.D., LL.D. Professor of Surgery, School of Medicine, Tulane University; Senior, Department of Surgery, Touro Infirmary; Chief of Service, Surgical Division, Charity Hospital; ex-President, Louisiana State Medical Society, 1894–5; Vice-President, American Medical Association 1910. *President*, 1911. 3523 Prytania Street, New Orleans, La.

1917.—Maury, John M., M.D. Professor of Gynecology, University of Tennessee, College of Medicine; Gynecologist, Memphis General and Baptist Memorial Hospitals. Bank of Commerce Building, Memphis, Tenn.

1902.—Mayo, Charles H., M.D., A.M., LL.D., D.Sc., F.R.C.S. (Eng.). Surgeon to the Mayo Clinic, St. Mary's Hospital; Professor of Surgery, Medical School, and of the Mayo Foundation, University of Minnesota, Rochester, Minn.

1898.—Miller, C. Jeff, M.D. Professor of Obstetrics and Clinical Gynecology, School of Medicine, Tulane University of Louisiana; Chief of the Division of Obstetrics and Gynecology,

Charity Hospital; Chief of the Division of Gynecology, Touro Infirmary; Professor of Abdominal Surgery, Post-Graduate School of Medicine, Tulane University; Member of the American Gynecological Society. *Vice-President,* 1920. *President,* 1922. 1638 Joseph Street, New Orleans, La.

1916.—Miller, Edward Howe, Jr., M.D. Surgeon, Danville General Hospital; Surgeon to Southern Railway; Surgeon to Providence Hospital. 6 Chestnut Place, Danville, Va.

1917.—Miller, Robert Talbott, Jr., M.D. Associate in Surgery, Johns Hopkins University. Johns Hopkins Hospital, Baltimore, Md.

1907.—Mitchell, James F., M.D. Surgeon to Emergency Hospital. *Vice-President,* 1914. *President.* 1344 Nineteenth Street, Washington, D. C.

1921.—Mixter, Charles Galloupe, M.D. Assistant Surgeon, Children's Hospital, Boston, Mass.; Consulting Surgeon, Jordon Hospital, Plymouth, Mass.; Consulting Surgeon, Cable Hospital, Ipswich, Mass.; Consulting Surgeon, Leonard Morse Hospital, Natick, Mass.; Instructor in Surgery, Graduate School of Medicine, Harvard University. 180 Marlborough Street, Boston, Mass.

1901.—Mixter, Samuel Jason, M.D. Surgeon, Massachusetts General Hospital; Consulting Surgeon, Massachusetts Charity Eye and Ear Infirmary; Instructor of Surgery, Harvard Medical School. 180 Marlborough Street, Boston, Mass.

1911.—Moore, John Thomas, M.D. Surgeon, St. Joseph's Infirmary, and Municipal Hospital. Kress Medical Bldg., Houston, Texas.

1904.—Moran, John F., M.D. Professor of Obstetrics, Georgetown University; Obstetrician to Georgetown University Hospital and Columbia Hospital for Women. 2426 Pennsylvania Avenue, Washington, D. C.

*1902.—Morris, Lewis C., M.D. Professor of Gynecology and Abdominal Surgery, Graduate School of Medicine, University of Alabama; Gynecologist and Abdominal Surgeon, Hillman and St. Vincent's Hospitals; Surgeon, Children's Hospital; Consulting Surgeon, Employees Hospital, B. C. I. and Ry. Co.; Member, Jefferson County Medical Society, Medical Association, State of Alabama, American Medical Association, American Association of Obstetricians and Gynecologists. *Vice-President,* 1910. 1203–7 Empire Building, Birmingham, Ala.

* Deceased.

1900.—Morris, Robert Tuttle, M.D. Emeritus Professor of Surgery, New York Post-Graduate Medical School and Hospital; Visiting Surgeon, Broad Street Hospital. 616 Madison Avenue, New York, N. Y.

1916.—Newell, E. Dunbar, M.D. Surgeon to the Newell Sanitarium; Consulting Surgeon to the Erlanger Hospital; Surgeon, C. N. O. & T. P., A. G. S., and Southern Railways; Surgeon, N. C. & St. L. and W. & A. Chattanooga, Tenn.

1889.—Nicolson, William Perrin, M.D. Surgeon and President, Medical Board, St. Joseph's Infirmary; Consulting Surgeon, Grady Memorial Hospital; ex-President of the Georgia Medical Association; ex-Secretary, Surgical Section, Pan-American Medical Congress. *Vice-President,* 1900. Healey Building, Atlanta, Ga.

1890.—Noble, George H., M.D., D.C.L. Professor of Clinical Gynecology, Atlanta Medical College; Gynecologist to Grady Hospital; Fellow of the American Gynecological Society and the American Association of Obstetricians and Gynecologists; ex-President of the Medical Association of Georgia; ex-Secretary of the Section of Obstetrics, American Medical Association. *Vice-President,* 1901; *President,* 1906. 186 South Pryor Street, Atlanta, Ga.

1920.—Noland, Lloyd, M.D. Chief Surgeon Tennessee Coal, Iron and Railroad Company Employees' Hospital. Birmingham, Ala.

1911.—Norris, Henry, M.D. Rutherfordton, N. C.

1901.—Ochsner, A. J., M.D., LL.D. Adjunct Professor of Clinical Surgery, College of Physicians and Surgeons; Surgeon-in-Chief, Augustana and St. Mary's Hospital. 2106 Sedgwick Street, Chicago, Ill.

1903.—Ochsner, Edward H., M.D. Surgeon to Augustana Hospital. 2155 Cleveland Avenue, Chicago, Illinois.

1902.—Oliver, John Chadwick, M.D. Acting Dean and Professor of Surgery, Medical College of the University of Cincinnati; Director of the Surgical Service, Cincinnati General Hospital; Surgeon to Christ Hospital. 628 Elm Street, Cincinnati, Ohio.

1888.—Parham, F. W., M.D. Professor of Surgery in the New Orleans Polyclinic; One of the Chief Surgeons, Touro Infirmary. *Vice-President,* 1899; *President,* 1908. 1429 Seventh Street, New Orleans, La.

1910.—Payne, Robert Lee, M.D. Surgeon to St. Vincent's Hospital, Southern Railway, Clyde and Chesapeake Steamship Companies; Consulting Surgeon, Seaboard Air Line Railway; Chief Surgeon, Norfolk-Southern Railroad, and Roanoke River Railway. Tazewell Building, Norfolk, Va.

1916.—Peck, Charles H., M.D. Professor of Clinical Surgery, Columbia University; Surgeon to Roosevelt Hospital; Consulting Surgeon to French, Ruptured and Crippled, and Memorial Hospitals. 30 W. Fiftieth Street, New York, N. Y.

1921.—Pemberton, John de J., M.D. Section of Surgery, Mayo Clinic. Rochester, Minn.

1920.—Peple, W. Lowndes, M.D. Professor of Clinical Surgery, Medical College of Virginia; Chief of Surgical Services of the Memorial, Dooley and St. Philip Hospitals; Chairman of Staff and Chief of Surgical Service of the Virginia Hospital. 1209 W. Franklin Street, Richmond, Va.

*1899.—Platt, Walter Brewster, M.D. Surgeon to the Robert Garrett Hospital for Children. 802 Cathedral Street, Baltimore, Md.

1917.—Pool, Eugene H., M.D. Consultant Surgeon to French Hospital, Port Chester Hospital, Central Islip State Asylum, New York Orthopedic Hospital, and Home for Incurables. 107 East Sixtieth Street, New York, N. Y.

1922.—Rankin, Fred W., A.B., A.M., M.D. Professor of Surgery, Medical Department University of Louisville, Ky.

1911.—Reder, Francis, M.D. Surgeon, St. Louis City and St. John's Hospitals. University Club Building, St. Louis, Mo.

1914.—Rhodes, Goodrich Barbour, A.B., M.D. Associate Clinical Professor of Surgery, Medical College of the University of Cincinnati; Attending Surgeon, Cincinnati General Hospital and Episcopal Hospital for Children. The Ortiz, Fourth and Sycamore Streets, Cincinnati, Ohio.

1917.—Rhodes, Robert L., A.B., M.D. Associate in Surgery, Medical Department, University of Georgia; Visiting Surgeon, the Wilhenford Hospital; Assistant Visiting Surgeon, the University Hospital. 1103–5 Lamar Building, Augusta, Ga.

1919.—Richardson, Edward Henderson, A.B., M.D. Associate in Clinical Gynecology, Johns Hopkins University, Medical Department; Visiting Gynecologist, Union Protestant Infirmary, Church Home and Infirmary, Hebrew Hospital and

* Deceased.

Asylum, Bay View Hospital, Hospital for Women of Maryland; Assistant Visiting Gynecologist, Johns Hopkins Hospital. 1200 N. Charles St., Baltimore, Maryland.

1912.—Richardson, Edward P., M.D. Assistant Visiting Surgeon to the Massachusetts General Hospital. 224 Beacon Street, Boston, Mass.

1921.—Roberson, Foy, M.D. Surgeon to Watts Hospital; Surgeon to State Hospital for the Insane. First National Bank Building, Durham, N. C.

1901.—Robins, Charles Russell, M.D. Professor of Gynecology, Medical College of Virginia; Surgeon, Stuart Circle Hospital; Gynecologist, Memorial Hospital; formerly Chief Surgeon to the Virginia Hospital; President, Stuart Circle Hospital Corporation. *Vice-President*, 1919. 8 West Grace Street, Richmond, Va.

1917.—Robinson, Julian McG., M.D. 753 Main Street, Danville, Va.

1906.—Rogers, Carey Pegram, M.D. Chief of Surgical Staff, St. Luke's Hospital; Consulting Surgeon, Seaboard Air Line Railway. *Vice-President*, 1918. 221 Laura Street, Jacksonville, Florida.

1899.—Royster, Hubert Ashley, A.B., M.D. Surgeon to Rex Hospital; Surgeon-in-Chief, St. Agnes' Hospital; Surgeon to Southern Railway; Consulting Surgeon to the Seaboard Air Line; Surgeon to the State Hospital for the Insane. *Vice-President*, 1907. *Secretary*. 423 Fayetteville Street, Raleigh, N. C.

1909.—Ruffin, Kirkland, M.D. Surgeon-in-Charge of St. Christopher's Hospital. 218 York Street, Norfolk, Va.

1922.—Russ, Witten B., M.D. Chief Surgeon, Robert B. Green Memorial Hospital. City National Bank Building, San Antonio, Tex.

1921.—Sanders, R. L., M.D. Associate in Surgery, Memphis General Hospital; Visiting Surgeon, Baptist Memorial Hospital; Associate Professor of Surgery, University of Tennessee. Goodwyn Institute Building, Memphis, Tenn.

1893.—Saunders, Bacon, M.D. Professor of Surgery, Baylor School of Medicine, Dallas, Texas; ex-President, Texas State Medical Association; Chief Surgeon, Fort Worth and Denver City and Wichita Valley Railway Companies. *Vice-President*, 1903; *Member of Council*, 1908–1913. *President*, 1915. Flatiron Bldg., Fort Worth, Texas.

1907.—Scott, Arthur Carroll, M.D. Senior Surgeon, Temple Sanatorium. *Vice-President*, 1914. Temple, Texas.

1915.—Seelig, Major G., A.B., M.D. Professor of Surgery, Washington University School of Medicine; Attending Surgeon, Jewish Hospital; Chief of Surgical Out-Patient Department, Jewish Hospital. University Club Building, St. Louis, Mo.

1922.—Shallenberger, William F., A.B., A.M., M.D. Associate Professor of Gynecology, Emory University Medical School; Visiting Gynecologist to Grady Hospital and Wesley Memorial Hospital. 820 Hurt Building, Atlanta, Ga.

1899.—Shands, A. R., M.D. Professor of Orthopedic Surgery in the Medical Department of the George Washington University and in the University of Vermont; Orthopedic Surgeon to the George Washington University Hospital, the Emergency Hospital, and Central Dispensary; Charter Member, Washington Academy of Sciences; Member of American Orthopedic Association; and Honorary Member of Medical Society of Virginia. 901 Sixteenth Street, N. W., Washington, D. C.

1914.—Shands, Harley R., A.B., M.D. Visiting Surgeon, Mississippi State Charity and Baptist Hospitals. Century Building, Jackson, Miss.

1917.—Sherk, Henry H., M.D. Attending Surgeon, Pasadena Hospital; Surgeon, La Vina Sanitarium for the Tubercular. Central Building, Pasadena, Cal.

1902.—Sherrill, J. Garland, M.D. Professor of Surgery and Clinical Surgery, University of Louisville; Consulting Surgeon to Louisville Hospital. *Vice-President*, 1911. Masonic Building, Louisville, Ky.

1913.—Simpson, James Knox, M.D. Chief Surgeon, St. Luke's Hospital; Orthopedic Surgeon to Florida State Fund for Crippled Children. Jacksonville, Fla.

1920.—Singleton, Albert O., B.S., M.D. Associate Professor of Surgery, Medical Department, University of Texas, and Lecturer in Genito-urinary Diseases; Attending Surgeon to John Sealey Hospital. American National Insurance Building, Galveston, Texas.

1917.—Sistrunk, W. E., M.D. Mayo Clinic, Rochester, Minnesota.

1919.—Smyth, John, M.D. 724 Baronne St., New Orleans, Louisiana.

1899.—Smythe, Frank David, M.D. Gynecologist to St. Joseph's Hospital and President of the Staff; Lieut.-Col.,

Medical Corps, U. S. Army during the World War; ex-President, West Tennessee Medical and Surgical Society; formerly Member of the Board of Health and Examining Board of the State of Mississippi. 730–33 Exchange Building, Memphis, Tenn.

1916.—Souchon, Marion, M.D. Visiting Surgeon, Hotel Dieu; Surgeon, French Hospital; Assistant Professor of Clinical Surgery, Tulane University. Whitney Bank Bldg., New Orleans, La.

1904.—Stokes, James Ernest, M.D. *Vice-President*, 1917. Salisbury, N. C.

1918.—Stone, Harvey B., A.B., M.D. Instructor in Clinical Surgery, Johns Hopkins University; Assistant Visiting Surgeon, Johns Hopkins Hospital; Member of Staff, Union Memorial Hospital, Church Home and Infirmary, Mercy Hospital and Hebrew Hospital. 18 West Franklin Street, Baltimore, Md.

1920.—Sullivan, Raymond Peter, A.B., A.M., M.D. Surgeon to St. Vincent's and Holy Family (Brooklyn) Hospitals; Consulting Surgeon, King's Park Hospital, King's Park, N. Y. 270 Park Avenue, New York, N. Y.

1894.—Talley, Dyer F., A.M., M.D. Surgeon-in-Chief of Talley's Private Infirmary; Attending Surgeon to Hillman Hospital; ex-President of the Jefferson County Medical Society; Member of the Medical Association of the State of Alabama, of the Southern Medical Association, of the Alumni Association of the Charity Hospital of Louisiana, of the Board of Censors of the Jefferson County Medical Society, of the Board of Censors of the Committee of Health and Examining Board of the Medical Association of the State of Alabama; ex-Member of the Advisory Board for Selective Draft; Fellow of the American College of Surgeons. 1808 Seventh Avenue, Birmingham, Alabama.

1921.—Taylor, Julius Heyward, M.D. Surgeon to the Baptist Hospital; Consulting Surgeon to the State Hospital for the Insane and to the Camden Hospital, Camden, S. C. Medical Building, Columbia, S. C.

1892.—Thompson, J. E., M.B., B.S. (London), F.R.C.S. (Eng.). Professor of Surgery in the University of Texas. *Vice-President*, 1912; *President*, 1919. Galveston, Tex.

1916.—Thorning, W. Burton, M.D. Chief Surgeon of the Gulf Coast Lines. Kress Building, Houston, Texas.

1908.—Torrance, Gaston, M.D. Member Surgical Staff Hillman Hospital; also the Sisters' Hospital and St. Vincent's;

Fellow of the American Association of Obstetricians and Gynecologists. 328 Woodward Building, Birmingham, Ala.

1909.—Trout, Hugh Henry, M.D. Surgeon-in-Chief of Jefferson Hospital, Roanoke, Va. *Vice-President,* 1921. 1303 Franklin Road, Roanoke, Va.

1917.—Tupper, Paul Y., M.D. Clinical Professor of Surgery, Washington University Medical School; Visiting Surgeon St. Luke's Hospital; Consulting Surgeon, Missouri Baptist Sanitarium, Bethesda, Jewish and St. John's Hospitals, St. Louis Eye, Ear, Nose and Throat Infirmary. Wall Building, St. Louis, Mo.

1921.—Van Beuren, Frederick T., Jr., M.D. Associate Dean and Associate in Surgery, College of Physicians and Surgeons, Columbia University; Attending Surgeon, Sloane Hospital for Women. 437 West Fifty-ninth Street, New York, N. Y.

1909.—Vaughan, George Tully, M.D., LL.D. Professor of Surgery and Head of Department of Surgery in Georgetown University; Chief Surgeon in Georgetown University Hospital; Visiting Surgeon, Tuberculosis Hospital; Consulting Surgeon, St. Elizabeth's Hospital; Consulting Surgeon, Washington Asylum Hospital; Consulting Surgeon, U. S. Public Health Service; Commander, Medical Corps, Reserve Force, U. S. Navy. 1718 I Street, Washington, D. C.

1919.—Venable, Charles Scott, M.D. Attending Surgeon Lee Surgical Hospital, San Antonio, Texas; Attending Surgeon, Robert B. Green Memorial Hospital, San Antonio, Texas. Central Trust Building, San Antonia, Texas.

1912.—Walker, George, M.D. Associate in Surgery, Johns Hopkins University. 1 E. Centre St., Baltimore, Maryland.

1911.—Waring, T. P., M.D. Savannah, Ga.

1905.—Wathen, John R., A.B., M.D. Professor of Surgery and Clinical Surgery, University of Louisville; Surgeon to St. Anthony's, and Louisville City Hospitals. 350 Francis Building, Louisville, Ky.

1907.—Watts, Stephen H., M.D. Professor of Surgery University of Virginia; Surgeon-in-Chief of the University of Virginia Hospital. University of Virginia, Charlottesville, Va.

1888.—Westmoreland, Willis F., M.D. Professor of Surgery, Atlanta College of Physicians and Surgeons. *Vice-President,* 1908. 241 Equitable Building, Atlanta, Ga.

1907.—Willis, A. Murat, M.D. Instructor in Abdominal Surgery, Medical College of Virginia; Junior Surgeon to Memorial Hospital, Richmond, Va. 405 East Grace Street, Richmond, Va.

1913.—Windell, James Tolbert, M.D. 715 West Jefferson Street, Louisville, Ky.

1921.—Winslow Nathan, M.D. Clinical Professor of Surgery in the University of Maryland; Visiting Surgeon to the University Hospital. 1900 Mt. Royal Terrace, Baltimore, Md.

1905.—Winslow, Randolph, M.D., LL.D. Emeritus Professor of Surgery, University of Maryland. *President*, 1921. 1900 Mt. Royal Terrace, Baltimore, Md.

1905.—Witherspoon, T. Casey, M.D. Formerly Professor of Operative and Clinical Surgery, Medical Department, St. Louis University; Member of American Association of Anatomists. Murray Hospital, Butte, Mont.

GEOGRAPHICAL LIST OF FELLOWS

ALABAMA

Baker, James Norment, 602 S. Perry St., Montgomery.
Cole, Herbert Phalon, Van Antwerp Bldg., Mobile.
Du Bose, Francis Goodwin, Selma.
Heflin, Wyatt, 3216 Cliff Road, Birmingham.
Hill, Robert Somerville, Montgomery.
Hogan, Edgar P., 412–14 Empire Bldg., Birmingham.
Jordan, William Mudd, 915 Empire Bldg., Birmingham.
Ledbetter, Samuel L., Jr., 516 Empire Bldg., Birmingham.
Lupton, Frank A., 816 Woodward Bldg., Birmingham.
McAdory, Wellington P., Birmingham.
Mason, J. M., 1915 Sixteenth Ave., S., Birmingham.
Mastin, William M., Joachim and Conti Sts., Mobile.
Noland, Lloyd, Employees' Hospital, Birmingham.
Talley, Dyer F., 1801 Seventh Ave., Birmingham.
Torrance, Gaston, 328 Woodward Bldg., Birmingham.

CALIFORNIA

Gilcreest, Edgar L., 3698 California St., San Francisco.
Sherk, Henry H., Central Building, Pasadena.

FLORIDA

Helms, John Sullivan, Tampa.
Holden, Gerry R., 513 Laura St., Jacksonville.
Rogers, Carey Pegram, 221 Laura St., Jacksonville.
Simpson, James Knox, Jacksonville.

GEORGIA

Boland, Frank K., Candler Bldg., Atlanta.
Dowman, Charles E., 78 Forrest Ave., Atlanta.
Elkin, William Simpson, 1029 Candler Bldg., Atlanta.
Goldsmith, W. S., 262 Jackson St., Atlanta.

Hodgson, Fred. G., 746 Peachtree St., Atlanta.
Nicolson, William Perrin, Healey Bldg, Atlanta.
Noble, George H., 186 S. Pryor St., Atlanta.
Rhodes, Robert L., 1103–5 Lamar Bldg., Augusta.
Shallenberger, William F., 820 Hurt Bldg., Atlanta.
Waring, T. P., Savannah.
Westmoreland, Willis F., 241 Equitable Bldg., Atlanta.

ILLINOIS

Cubbins, William R., 29 East Madison St., Chicago.
Lewis, Dean, 122 S. Michigan Ave., Chicago.
Martin, Franklin H., 30 North Michigan Ave., Chicago.
Ochsner, A. J., 2106 Sedgwick St., Chicago.
Ochsner, Edward H., 2155 Cleveland Ave., Chicago.

KENTUCKY

Abell, Irvin, 700 Francis Bldg., Louisville.
Barrow, David, 148 Market St., Lexington.
Barrow, D. Woolfolk, 190 N. Upper St., Lexington.
Farmer, Charles, 1110 Francis Bldg., Louisville.
Frank, Louis, 400 Atherton Bldg., Louisville.
Hanes, Granville S., Francis Bldg., Louisville.
Hendon, George A., 646 Francis Bldg., Louisville.
Rankin, F. W., Louisville.
Sherrill, J. Garland, Masonic Bldg., Louisville.
Wathen, John R., 350 Francis Bldg., Louisville.
Windell, James T., 715 West Jefferson St., Louisville.

LOUISIANA

Allen, Carroll W., 43 Audubon Boulevard, New Orleans.
Clark, S. M. D., 1435 Harmony St., New Orleans.
Cocram, Henry S., 108 Baronne St., New Orleans.
Cohn, Isidore, 1522 Aline St., New Orleans.
Danna, Joseph A., Charity Hospital, New Orleans.
Gessner, Herman B., 1105 Maison Blanche Bldg., New Orleans.
Landry, Lucian H., 2255 St. Charles Ave., New Orleans.
Maes, Urban, 1671 Octavia St., New Orleans.
Martin, E. Denegre, 3513 Prytania St., New Orleans.
Matas, Rudolph, 3523 Prytania St., New Orleans.
Miller, C. Jeff, 1638 Joseph St., New Orleans.

Parham, F. W., 1429 Seventh St., New Orleans.
Smyth, John, 724 Baronne St., New Orleans.
Souchon, Marion, Whitney Bank Bldg., New Orleans.

MAINE

Cousins, William Lewis, 231 Woodford St., Portland.

MARYLAND

Baer, William S., 4 E. Madison St., Baltimore.
Bagley, Charles, Jr., The Latrobe, Baltimore.
Bloodgood, Joseph C., 904 N. Charles St., Baltimore.
Burnam, Curtis Field, 1418 Eutaw Place, Baltimore.
Cullen, Thomas Stephen, 20 E. Eager St., Baltimore.
Davis, John Staige, The Severn, Baltimore.
Fisher, Wm. A., Jr., 715 Park Ave., Baltimore.
Finney, J. M. T., 1300 Eutaw Place, Baltimore.
Hunner, Guy LeRoy, 2305 St. Paul St., Baltimore.
Kelly, Howard Atwood, 1418 Eutaw Place, Baltimore.
McGlannan, Alexius, 115 W. Franklin St., Baltimore.
Miller, Robert T., Jr., Johns Hopkins Hospital, Baltimore.
Richardson, Edward H., 1200 N. Charles St., Baltimore.
Stone, Harvey B., 18 West Franklin St., Baltimore.
Walker, George, 1 E. Centre St., Baltimore.
Winslow, Nathan, 1900 Mount Royal Terrace, Baltimore.
Winslow, Randolph, 1900 Mount Royal Terrace, Baltimore.

MASSACHUSETTS

Jones, Daniel F., 195 Beacon St., Boston.
Marcy, Henry Orlando, 180 Commonwealth Ave., Boston.
Mixter, Charles G., 180 Marlborough St., Boston.
Mixter, Samuel Jason, 180 Marlborough St., Boston.
Richardson, Edward P., 224 Beacon St., Boston.

MINNESOTA

Balfour, Donald Church, Rochester.
Judd, Edward Starr, Rochester.
Law, Arthur Ayer, Syndicate Bldg., Minneapolis.
Mayo, Charles H., Rochester.
Pemberton, John de J., Rochester.
Sistrunk, W. E., Rochester.

MISSISSIPPI

Barksdale, John W., Winona.
Crawford, Walter W., Hattiesburg.
Shands, Harley R., Century Bldg., Jackson.

MISSOURI

Allison, Nathaniel, 608 Humboldt Bldg., St. Louis.
Bailey, Fred W., 611 Metropolitan Bldg., St. Louis.
Bartlett, Willard, 410 Metropolitan Bldg., St. Louis.
Blair, Vilray Papin, Metropolitan Bldg., St. Louis.
Clopton, Malvern B., Humboldt Building, St. Louis, Mo.
Elbrecht, O. H., 423 Metropolitan Bldg., St. Louis.
Jonas, Ernst, 4495 Westminster Place, St. Louis.
Kirchner, Walter C. G., 508 N. Grand Ave., St. Louis.
Lewis, Bransford, Century Bldg., St. Louis.
Reder, Francis, University Club Bldg., St. Louis.
Seelig, Major G., University Club Bldg., St. Louis.
Tupper, Paul Y., Wall Bldg., St. Louis.

MONTANA

Witherspoon, T. Casey, Murray Hospital, Butte.

NEW JERSEY

Ill, Edward Joseph, 1002 Broad St., Newark.

NEW YORK

Boldt, Herman J., 616 Madison Ave., New York City.
Coley, William B., 6 West 50th St., New York City.
Downes, William Augustus, 424 Park Ave., New York City.
Gerster, John C. A., 18 E. 78th St., New York City.
Lloyd, Samuel, 50 E. 42d St., New York City.
Morris, Robert Tuttle, 616 Madison Ave., New York City.
Peck, Charles H., 30 W. 50th St., New York City.
Pool, Eugene H., 107 E. 60th St., New York City.
Sullivan, R. P., 270 Park Ave., New York City.
Van Beuren, Frederick T. Jr., 437 W. 59th St., New York City.

NORTH CAROLINA

Biggs, Montgomery Herman, Rutherfordton.
Gibbon, Robert L., Charlotte.
Griffith, F. Webb, Haywood Bldg., Asheville.
Norris, Henry, Rutherfordton.
Roberson, Foy, First National Bank Bldg., Durham.
Royster, Hubert Ashley, 423 Fayetteville St., Raleigh.
Stokes, James Ernest, Salisbury.

OHIO

Bonifield, Charles Lybrand, 409 Broadway, Cincinnati.
Caldwell, C. E., The Livingston, 7th and Race Sts., Cincinnati.
Carothers, Robert, 409 Broadway, Cincinnati.
Crile, George W., 1021 Prospect Ave., Cleveland.
Hall, Rufus Bartlett, 628 Elm St., Cincinnati.
Heuer, George J., Cincinnati General Hospital, Cincinnati.
Lower, William E., Euclid Ave., at 93d St., Cleveland.
Oliver, John Chadwick, 628 Elm St., Cincinnati.
Rhodes, Goodrich Barbour, The Ortiz, 4th and Sycamore St., Cincinnati.

OREGON

Coffey, Robert C., Stevens Building, Portland.

PENNSYLVANIA

Clark, John G., 2017 Walnut St., Philadelphia.
Deaver, John B., 1634 Walnut St., Philadelphia.
Frazier, Charles H., 1724 Spruce St., Philadelphia.
Gibbon, John H., 1608 Spruce St., Philadelphia.
Guthrie, Donald, Sayre.

SOUTH CAROLINA

Buist, A. Johnston, 279 Meeting St., Charleston.
Cathcart, R. S., 75 Hasell St., Charleston.
Guerry, Le Grand, Columbia.
Taylor, Julius H., Medical Bldg., Columbia.

TENNESSEE

Barr, Richard Alexander, 800 Nineteenth Ave., S., Nashville.
Black, William T., Exchange Bldg., Memphis.
Bryan, W. A., 146 Eighth Ave., N., Nashville.
Burch, Lucius E., 210 Doctors' Bldg., Nashville.
Caldwell, Robert, 510 Jackson Bldg., Nashville.
Cowden, Charles N., Hitchcock Bldg., Nashville.
Crisler, Joseph Augustus, Exchange Bldg., Memphis.
Crook, Jere L., 110 W. Baltimore St., Jackson.
Dixon, W. C., 216 Doctors' Bldg., Nashville.
Haggard, William David, 706 Church St., Nashville.
McGehee, John L., Central Bank Bldg., Memphis.
Malone, Battle, 624 Exchange Bldg., Memphis.
Maury, John M., Bank of Commerce Bldg., Memphis.
Newell, E. Dunbar, Chattanooga.
Sanders, R. L., Goodwyn Institute Bldg., Memphis.
Smythe, Frank David, 730–33 Exchange Bldg., Memphis.

TEXAS

Beall, Frank C., 703 Lamar St., Fort Worth.
Moore, John Thomas, Kress Bldg., Houston.
Russ, Witten B., City National Bank Bldg., San Antonio.
Saunders, Bacon, Flatiron Bldg., Fort Worth.
Scott, Arthur Carroll, Temple.
Singleton, Albert O., American National Insurance Bldg., Galveston.
Thompson, J. E., Galveston.
Thorning, W. Burton, Kress Bldg., Houston.
Venable, Charles S., Central Trust Building, San Antonio.

VIRGINIA

Baughman, Greer, 26 N. Laurel St., Richmond.
Bell, Richard Phillips, 202 Professional Bldg., Staunton.
Bryan, Robert C., Grace Hospital, Richmond.
Coleman, Claude C., 503 Professional Bldg., Richmond.
Culpepper, J. H., 109 College Place, Norfolk.
Gwathmey, Lomax, Norfolk.
Henson, J. W., 405 N. Allen St., Richmond.
Horsley, John Shelton, 617 W. Grace St., Richmond.
La Roque, G. Paul, 603 East Grace St., Richmond.
Leigh, Southgate, 109 College Place, Norfolk.

McGuire, Stuart, 513 E. Grace St., Richmond.
MacLean, Henry Stuart, 401 W. Grace St., Richmond.
Miller, Edward Howe, Jr., 6 Chestnut Place, Danville.
Payne, Robert Lee, Tazewell Bldg., Norfolk.
Peple, W. Lowndes, 1209 W. Franklin St., Richmond.
Robins, Charles Russell, 8 W. Grace St., Richmond.
Robinson, Julian McG., 753 Main St., Danville.
Ruffin, Kirkland, 218 York St., Norfolk.
Trout, Hugh Henry, 1303 Franklin Road, Roanoke.
Watts, Stephen H., Charlottesville.
Willis, A. Murat, 405 E. Grace St., Richmond.

WEST VIRGINIA

Cannaday, John Egerton, Kanawha Banking and Trust Co. Bldg., Charleston.
Hupp, Frank Le Moyne, 61 Fourteenth St., Wheeling.

WASHINGTON, D. C.

Bovée, J. Wesley, The Rochambeau.
Hagner, Francis Randall, The Farragut.
Kerr, Harry Hyland, 1742 N. St., N. W.
Mitchell, James F., 1344 Nineteenth St.
Moran, John F., 2426 Pennsylvania Ave.
Shands, A. R., 901 Sixteenth St., N. W.
Vaughan, George Tully, 1718 I St.

CONSTITUTION

ARTICLE I

The name of this Association shall be THE SOUTHERN SURGICAL ASSOCIATION.

ARTICLE II

The object of this Association shall be to further the study and practice of Surgery in its various departments, especially among the profession of the Southern States.

ARTICLE III

SECTION 1. The qualifications which must be possessed by an applicant for fellowship in the Association shall be: (*a*) Good standing in his State Association; (*b*) experience covering not less than ten years of professional work; (*c*) practice limited essentially to surgery or one of its specialties; (*d*) recommendation by three Fellows, two preferably from his own State.

SECTION 2. Application for Fellowship shall be filed with the Secretary on the blank form provided for that purpose. The Council at each annual session shall carefully consider all candidates and may nominate one for each vacancy that exists on the roll for election or rejection by the Association.

ARTICLE IV

The Honorary Fellows of the Association shall not exceed twenty-five in number. They shall be nominated by the Council and elected by the Association. They will not be required to pay any dues and shall enjoy all the privileges of other Fellows except that of voting or holding office; this exception does not apply to Founders.

Any Fellow who has held fellowship for twenty years or more may become a Senior Fellow upon application to and recommendation by the Council and election by the Association. Senior Fellows will be exempt from the payment of dues, but shall have the privilege of voting and of holding office.

ARTICLE V

SECTION 1. The officers of this Association shall be a President, two Vice-Presidents, a Secretary, a Treasurer, and a Council, elected by ballot.

SEC. 2. The President and Vice-Presidents shall be elected for one year, and the President shall not be eligible for reëlection at any time; the Secretary and Treasurer, each, for five years; and the Council as provided for in the By-laws.

ARTICLE VI

SECTION 1. It shall be the duty of the President to preside at all meetings of the Association; to give the casting vote; to see that the rules of order and decorum be properly enforced in all deliberations of the Association; to sign the approved proceedings of each meeting, and to approve such orders as may be drawn upon the Treasurer for expenditures ordered by the Association.

SEC. 2. In the absence of the President the first Vice-President shall preside, and in his absence the second Vice-President shall preside.

SEC. 3. In the absence of all three, the Association shall elect one of its Fellows to preside *pro tem.*

SEC. 4. It shall be the duty of the Secretary to keep a true and correct record of the proceedings of the meetings; to preserve all books, papers, and articles belonging to the archives of the Association; to attest all orders drawn on the Treasurer for moneys appropriated by the Association; to keep the account of the Association with its Fellows; to keep a register of the Fellows, with the dates of their admission and places of residence. He shall collect all moneys due from the Fellows and pay to the Treasurer, taking his receipt for the same. He shall report such unfinished business of previous meetings as may appear on his books requiring action, and attend to such other business as the Association may direct. He shall also supervise and conduct all the correspondence of the Association, and edit the TRANSACTIONS under the direction of the Council.

SEC. 5. It shall be the duty of the Treasurer to keep a correct record of all moneys received from the hands of the Secretary, giving his receipt for the same; pay them out by order of the Association as indorsed by the President and attested by the seal in the hands of the Secretary.

Sec. 6. It shall be the duty of the President of the Association to appoint an Auditing Committee, consisting of three Fellows of the Association, whose duty it shall be to examine the books of the Secretary and Treasurer, and report on the same on the last day of the session.

ARTICLE VII

Vacancies occurring in the offices of the Association shall be filled by appointment of the President until the next meeting. He shall also have the appointment of all committees not otherwise provided for.

ARTICLE VIII

This Constitution shall take effect immediately from the time of its adoption, and shall not be amended except by a written resolution, which shall lie over one year, and receive a vote of two-thirds of the members present.

ARTICLE IX

The Fellowship of the Association shall be limited to two hundred.

BY-LAWS

ARTICLE I

The Southern Surgical Association shall meet annually on the Tuesday of the week preceding the week in which Christmas occurs, at 10 A.M., at such place as may be designated at the preceding meeting.

ARTICLE II

The Fellows present shall constitute a quorum for business.

ARTICLE III

The annual dues of each Fellow shall be $15, paid in advance.

ARTICLE IV

The usual parliamentary rules governing deliberative bodies shall govern the business workings of this Association.

ARTICLE V

All questions before the Association shall be determined by a majority of the votes present.

ARTICLE VI

The President shall deliver an annual address at each meeting of the Association.

ARTICLE VII

The Secretary of the Association shall receive at each annual Session a draft from the President, drawn on the Treasurer, for such sum as may be voted him by the Council, for services rendered the Association, and to this shall be added the necessary expense incurred in the discharge of his official duties.

ARTICLE VIII

It shall be the duty of the Secretary, one month prior to the annual meeting, to notify the Fellows of the Association and urge their attendance.

ARTICLE IX

The authors of papers shall notify the Secretary, six weeks prior to the meeting, of the titles of their essays, so that they may be incorporated in the preliminary programme.

ARTICLE X

COUNCIL

The Council shall consist of five members; and of those elected at the primary meeting, the first shall serve five years, the second four, and the third three, the fourth two, and the fifth one year; so that subsequently one member of the Council shall be elected annually to serve five years. No member of the Council shall be eligible for reëlection. The President and Secretary shall be *ex-officio* members of the Council.

This Council shall organize by electing a Chairman and Secretary, and shall keep a record of its proceedings.

The duties of this Council shall be—

1. To investigate applications for membership and report to the Association the names of such persons as are deemed worthy.

2. To take cognizance of all questions of an ethical, judicial, or personal nature, and upon these the decision of the Council shall be final; *provided,* that appeal may be taken from such decision of the Council to the Association, under a written protest, which protest shall be sustained by the Association, and the matter shall then be referred to a special committee, with power to take final action.

3. All motions and resolutions before the Association shall be referred to the Council without debate, and it shall report by recommendation at as early an hour as possible.

ARTICLE XI

The President shall appoint at each annual meeting a Committee of Arrangements.

ARTICLE XII

The Council shall have full power to omit from the published TRANSACTIONS, in part or in whole, any paper that may be referred to it by the Association, unless specially instructed to the contrary by the Association, which will be determined by vote.

ARTICLE XIII

The Council shall have power to drop from the roll of Fellows any member who fails to pay his dues for more than one year, or misses three consecutive sessions of the Association, or who for any reason fails to retain his good standing in his State association.

ARTICLE XIV

No paper shall be read before this Association which does not deal strictly with a subject of surgical or gynecological importance.

ARTICLE XV

No paper read before this Association shall be published in any medical journal or pamphlet for circulation, as having been read before the Association, without having received the endorsement of the Council.

ARTICLE XVI

The readings of papers shall be limited to twenty minutes each, except by permission of the Association.

MINUTES OF THE PROCEEDINGS

OF THE

THIRTY-FIFTH ANNUAL MEETING

OF THE

SOUTHERN SURGICAL ASSOCIATION

HELD AT THE

CHISCA HOTEL

Memphis, Tennessee

DECEMBER 12, 13 AND 14, 1922

THIRTY-FIFTH ANNUAL MEETING

First Day, *Tuesday, December* 12, 1922

The following named Fellows were present:

Abell, Irvin.....Louisville, Ky.
Bagley, Charles, Jr.....Baltimore, Md.
Bailey, Fred Warren.....St. Louis, Mo.
Balfour, Donald C.....Rochester, Minn.
Barksdale, John W.....Winona, Miss.
Barr, Richard Alexander.....Nashville, Tenn.
Bartlett, Willard.....St. Louis, Mo.
Beall, Frank Cooke.....Fort Worth, Texas.
Black, William T.....Memphis, Tenn.
Blair, Vilray Papin.....St. Louis, Mo.
Boland, Frank K.....Atlanta, Ga.
Boldt, Herman J.....New York, N. Y.
Bonifield, Charles L.....Cincinnati, Ohio.
Bryan, W. A.....Nashville, Tenn.
Burch, Lucius E.....Nashville, Tenn.
Caldwell, Robert.....Nashville, Tenn.
Carothers, Robert.....Cincinnati, Ohio.
Clark, S. M. D.....New Orleans, La.
Clopton, Malvern B.....St. Louis, Mo.
Coley, William B.....New York, N. Y.
Crawford, Walter W.....Hattiesburg, Miss.
Crisler, Joseph A.....Memphis, Tenn.
Crook, Jere L.....Jackson, Tenn.
Danna, Joseph A.....New Orleans, La.
Davis, John Staige.....Baltimore, Md.
Dixon, W. C.....Nashville, Tenn.
Dowman, Charles E.....Atlanta, Ga.
Downes, William A.....New York, N. Y.
Du Bose, Francis Goodwin.....Selma, Ala.
Fletcher, Marshall H.....Asheville, N. C.

Frank, Louis.....Louisville, Ky.
Frazier, Charles H.....Philadelphia, Pa.
Gessner, Herman B.....New Orleans, La.
Gibbon, Robert L.....Charlotte, N. C.
Gilcreest, Edgar L.....San Francisco, Cal.
Goldsmith, W. S.....Atlanta, Ga.
Haggard, William D.....Nashville, Tenn.
Hagner, Francis R.....Washington, D. C.
Hall, Rufus Bartlett.....Cincinnati, Ohio.
Heflin, Wyatt.....Birmingham, Ala.
Helms, John Sullivan.....Tampa, Fla.
Hendon, George A.....Louisville, Ky.
Hodgson, Fred G.....Atlanta, Ga.
Hogan, Edgar P.....Birmingham, Ala.
Jordan, William Mudd.....Birmingham, Ala.
Judd, Edward Starr.....Rochester, Minn.
Kerr, Harry Hyland.....Washington, D. C.
Kirchner, Walter C. G.....St. Louis, Mo.
Landry, Lucian H.....New Orleans, La.
Ledbetter, Samuel L., Jr.....Birmingham, Ala.
Leigh, Southgate.....Norfolk, Va.
Lewis, Bransford.....St. Louis, Mo.
Lewis, Dean.....Chicago, Ill.
Lupton, Frank A.....Birmingham, Ala.
Lower, William E.....Cleveland, Ohio.
MacLean, Henry Stuart.....Richmond, Va.
Maes, Urban.....New Orleans, La.
Malone, Battle.....Memphis, Tenn.
Martin, E. Denegre.....New Orleans, La.
Mason, J. M.....Birmingham, Ala.
Mastin, William M.....Mobile, Ala.
Matas, R.....New Orleans, La.
Maury, John M.....Memphis, Tenn.
Mayo, Charles H.....Rochester, Minn.
Miller, C. Jeff.....New Orleans, La.
Mitchell, James F.....Washington, D. C.
Mixter, Charles G.....Boston, Mass.
Moore, John T.....Houston, Texas.
Newell, E. Dunbar.....Chattanooga, Tenn.
Noble, George H.....Atlanta, Ga.
Noland, Lloyd.....Birmingham, Ala.
Oliver, John C.....Cincinnati, Ohio.

Pool, Eugene H. . . . . New York, N. Y.
Reder, Francis . . . . . St. Louis, Mo.
Rhodes, Goodrich Barbour . . . . . Cincinnati, Ohio.
Richardson, Edward P . . . . . Boston, Mass.
Roberson, Foy . . . . . Durham, N. C.
Robins, Charles R . . . . . Richmond, Va.
Royster, Hubert A . . . . . Raleigh, N. C.
Sanders, R. L . . . . . Memphis, Tenn.
Saunders, Bacon . . . . . Forth Worth, Texas.
Scott, Arthur C . . . . . Temple, Texas.
Seelig, Major G . . . . . St. Louis, Mo.
Shands, Harley R . . . . . Jackson, Miss.
Sherrill, J. Garland . . . . . Louisville, Ky.
Singleton, Albert O . . . . . Galveston, Texas.
Sistrunk, W. E . . . . . Rochester, Minn.
Smyth, John . . . . . New Orleans, La.
Smythe, Frank D . . . . . Memphis, Tenn.
Stokes, J. Ernest . . . . . Salisbury, N. C.
Taylor, Julius H . . . . . Columbia, S. C.
Thorning, W. Burton . . . . . Houston, Texas.
Torrance, Gaston . . . . . Birmingham, Ala.
Trout, Hugh H . . . . . Roanoke, Va.
Venable, Charles S . . . . . San Antonio, Texas.
Wathen, John R . . . . . Louisville, Ky.
Westmoreland, Willis F . . . . . Atlanta, Ga.
Windell, James Tolbert . . . . . Louisville, Ky.
Winslow, Nathan . . . . . Baltimore, Md.
Winslow, Randolph . . . . . Baltimore, Md.

The following Honorary Fellows were present:

Davis, John D. S . . . . . Birmingham, Ala.
Long, John Wesley . . . . . Greensboro, N. C.
McMurtry, Lewis S . . . . . Louisville, Ky.

Letters and telegrams of regret were received from the following: I. S. Stone, Washington, D. C.; Alexius McGlannan, Baltimore, Maryland; Le Grand Guerry, Columbia, South Carolina; Ernst Jonas, St. Louis, Missouri; Robert T. Morris, New York City; James E. Thompson, Galveston, Texas; Charles H. Peck, New York City; Henry O. Marcy, Boston, Massachusetts; Robert T. Miller, Jr., Baltimore, Maryland;

J. Shelton Horsley, Richmond, Virginia; J. Wesley Bovée, Washington, D. C.; Harvey B. Stone, Baltimore, Maryland; R. S. Hill, Montgomery, Alabama; Frank LeMoyne Hupp, Wheeling, West Virginia; and Nathaniel Allison, St. Louis, Missouri.

On motion, which was duly seconded and carried, the following visitors were extended the privileges of the floor: William B. Burns, Memphis, Tennessee; F. W. Rankin, Mooresville, North Carolina; H. L. Douglas and T. D. McKinney, Nashville, Tennessee; Isidore Cohn, New Orleans, Louisiana; A. C. Broders, Rochester, Minnesota; Charles Farmer, Louisville, Kentucky; Donald Munro, Boston, Massachusetts; W. W. Grant, Denver, Colorado; Woolfolk Barrow, Lexington, Kentucky and Charles A. Vance, Lexington, Kentucky.

Morning Session. The Association met in the ballroom of the Chisca Hotel, and was called to order at 10 A.M. by the Secretary.

Dr. Battle Malone, Chairman of the Committee of Arrangements, was introduced and on behalf of the Fellows of Memphis, extended a cordial and hearty welcome to the Association and expressed the hope that the stay of the Fellows in Memphis would be pleasant and profitable.

He announced the social events, stating that there would be no scientific session Tuesday afternoon. The afternoon would be devoted to outdoor recreation, golf, riding, motoring, etc.

Wednesday evening, at 8.15 o'clock, there would be theatricals by the Drama League at Hotel Chisca, which would be followed by a buffet supper, with dancing at the Tennessee Club. He also announced that the ladies would meet in the lobby of the hotel at 12.15, noon, at which time they would be met by the Memphis ladies and taken in cars to the Country Club at 1 P.M., and at 4 P.M. there would be a tea at the Nineteenth Century Club.

The Secretary then introduced the President of the Association, Dr. C. Jeff Miller, New Orleans, Louisiana, who immediately called for the reading of papers.

Papers were then read and discussed as follows:

1. "General Plastic Surgery," by Dr. John Staige Davis, Baltimore, Maryland, which was discussed by Dr. Reder.

2. "Autotransfusion," by Dr. L. E. Burch, Nashville, Tennessee.

3. "The Influence of Hemorrhage on the Mortality in Gunshot Wounds and Other Injuries of the Abdominal Viscera, with an Analysis of 69 Cases," by Dr. James M. Mason, Birmingham, Ala.

These two papers were discussed together by Drs. Boldt, Shands, Caldwell, Du Bose, Gilcreest, Singleton, Kirchner, Sherrill, Coley, Moore, Hogan, Bartlett, Seelig, Hendon, after which the discussion was closed by the essayists.

4. "Is the Proper Attention being Paid to Surgical Cleanliness?" by Dr. Southgate Leigh, Norfolk, Virginia.

This paper was discussed by Drs. Long, Boldt, Gilcreest and Reder.

5. "Traumatic Brain Lesions," by Dr. E. Dunbar Newell, Chattanooga, Tennessee.

Discussed by Drs. Maes, Long, and by the essayist.

On motion, the Association adjourned until 7.30 P.M.

Evening Session. The Association reconvened at 7.30 P.M., and was called to order by the President.

6. "Malunion and Nonunion of Fractures," by Dr. Dean Lewis, Chicago, Illinois.

7. "Important Considerations in the Treatment of Fractures of the Shaft of the Femur," by Dr. Albert O. Singleton, Galveston, Texas.

8. "The Near-normal Restoration of a Limb Afflicted with the Disabling Consequences of an Ancient Pott's Fracture," by Dr. Francis Reder, St. Louis, Missouri.

9. "Treatment of Compound Fractures of the Elbow-joint, and of the Lower End of the Humerus," by Dr. Edgar L. Gilcreest, San Francisco, California.

10. "Fractured Spine; Consideration of the Practical Care and Treatment," by Dr. Walter C. G. Kirchner, St. Louis, Missouri.

11. "Typhoidal Osteomyelitis," by Dr. Nathan Winslow, Baltimore, Maryland.

These six papers were discussed together by Drs. Carothers, Sherrill, Cohn (by invitation), Thorning and Martin, after which the discussion was closed by Drs. Gilcreest and Kirchner.

12. "Factors of Safety in Thyroid Surgery," by Dr. Willard Bartlett, St. Louis, Missouri.

13. "The Relative Value of Surgery and Roentgen-ray Therapy in Hyperthyroidism," by Dr. E. P. Richardson, Boston, Massachusetts.

These two papers were discussed jointly by Drs. Wathen, Sistrunk, Mayo, and in closing by Dr. Richardson.

On motion, the Association adjourned until 9 A.M., Wednesday, December 13.

SECOND DAY.—*Wednesday, December* 13, 1922

Morning Session. The Association met at 9.30 A.M., and was called to order by the President.

14. "Accidental Ureteral Injuries during Pelvic Operations," by Dr. John M. Maury, Memphis, Tennessee.

15. "Sarcoma of the Kidney in Infants," by Dr. Charles R. Robins, Richmond, Virginia.

16. "Mechanical Aids in the Diagnosis of Surgical Conditions of the Urinary Tract," by Dr. William E. Lower, Cleveland, Ohio.

17. "End-results in Malignant Disease of the Testis," by Dr. William B. Coley, New York.

18. "Spontaneous Hematoma Occurring in a Case of Spindle-celled Sarcoma of the Kidney," by Dr. Frank K. Boland, Atlanta, Georgia.

These four papers were discussed together by Drs. Bransford Lewis, C. G. Mixter, Hagner, Hall, Trout, Shands, after which the discussion was closed by the authors of the papers.

19. "A Study of Abscess of the Frontal Lobes of the Brain," by Dr. Harry H. Kerr, Washington, D. C.

20. "Brain Abscess with Pathological Observations," by Dr. Charles Bagley, Jr., Baltimore, Maryland.

These two papers were discussed together by Drs. Mason, Dowman and Du Bose.

21. "Partial Hypospadias and Pseudohermaphroditism," by Dr. Francis R. Hagner, Washington, D. C.

Discussed by Dr. Johnson, Memphis, Tennessee (by invitation).

22. "Pediculated Tumors which are Movable in the Stomach and Not Fixed to the Walls," by Dr. Rudolph Matas, New Orleans, Louisiana.

The President announced as Auditing Committee, Drs. Charles R. Robins, Francis Reder and George A. Hendon.

He also announced as members *pro tem.* of the Council, Drs. Bacon Saunders and Lewis S. McMurtry, in the absence of Drs. James E. Thompson and Isaac S. Stone.

On motion, the Association adjourned until 2 P.M.

Afternoon Session. The Association re-convened at 2 P.M. and was called to order by the Vice-President, Dr. V. P. Blair, St. Louis, Missouri.

23. President's Address: "Some Tendencies in Contemporary Medicine of Special Interest to the Surgeon," by Dr. C. Jeff Miller, New Orleans, Louisiana.

24. "Treatment of Diverticulum of the Esophagus," by Dr. Charles H. Mayo, Rochester, Minnesota, which was discussed by Dr. Bartlett, and in closing by the essayist.

25. "Acute Yellow Atrophy of the Liver with Nodular Hyperplasia," by Dr. E. H. Pool and Dr. F. W. Bancroft (by invitation) New York. Discussed by Dr. C. H. Mayo.

26. "Surgical Conditions of the Right Side of the Abdomen—So-called Chronic Appendix," by Dr. Willis F. Westmoreland, Atlanta, Georgia.

27. "Errors in Home Treatment of Appendicitis," by Dr. Fred W. Bailey, St. Louis, Missouri.

These two papers were discussed together by Drs. Robins, Mayo, Moore, Sherrill, Beall, Hogan, Lower, and in closing by the authors of the papers.

28. "Mesenteric Thrombosis," by Dr. James F. Mitchell, Washington, D. C.

Discussed by Drs. Noland, Mason, Bartlett, Reder, Richardson, Thorning, Matas, and in closing by the essayist.

29. "Strangulated Hernia of the Diaphragm, with Report of a Case," by Dr. Jere L. Crook, Jackson, Tennessee.

This paper was discussed by Drs. Grant (by invitation), Barrow (by invitation), Hall, J. D. S. Davis, Crisler, Smythe, Reder, Kirchner, and in closing by the essayist.

On motion, the Association adjourned until 9 A.M., Thursday, December 14.

THIRD DAY.—*Thursday, December* 14, 1922

Morning Session. The Association met at 9 A.M., and was called to order by the President.

30. "The Significance of Pain in the Back," by Dr. Robert Carothers, Cincinnati, Ohio. Discussed by Drs. Martin, Kirchner, and in closing by the essayist.

31. "Presentation of a Case of Ranula," by Dr. Vilray P. Blair, St. Louis, Missouri. Discussed by Dr. Sherrill.

32. "(*a*) An Unusually Large Renal Calculus with Pyonephrosis; (*b*) Invagination of the Caput Coli of Many Years' Duration," by Dr. J. Garland Sherrill, Louisville, Kentucky.

33. "White Bile in the Common Duct," by Dr. E. S. Judd, Rochester, Minnesota.

34. "Papilloma and Adenoma of the Gall-bladder," by Dr. Irvin Abell, Louisville, Kentucky.

35. "Surgery of the Acute Gall-bladder," by Dr. Robert Caldwell, Nashville, Tennessee.

These four papers were discussed jointly by Drs. Du Bose, Pool, Downes, Martin, Moore, Kirchner, Haggard, Reder and C. G. Mixter, after which the discussion was closed by Drs. Judd, Abell, and Caldwell.

Under the head of "Reports of Committees," Dr. Robins reported for the Auditing Committee, stating that the committee had examined the books of the Secretary, but as the Treasurer was not present and had not sent his books, the Committee could not check up the vouchers. However, there was a liberal balance in the treasury. Dr. William D. Haggard moved that a committee be appointed from among the Baltimore members to audit the books of the Treasurer. Seconded and carried.

The next order of business being the Report of the Council, the Secretary said: "Before presenting the formal report of the Council, I wish to make a few preliminary remarks. In the first place, I think we have really had a splendid meeting, in spite of the fact that the meeting has not been held at a so-called resort where we all like to go. Personally, I have enjoyed this meeting, because I had behind me—I believe I can say this without reservation—a loyal chairman and Committee of Arrangements of our Fellows in Memphis. The officers have never had better support in the performance of their duties than at this time. The total registration up to the present time is 104, which is only 2 less than the largest meeting in the history of the Association. The presence of our 'Associate Members,' the ladies and a large number of visitors, whom we are always glad to see, swells the ranks to approximately 150 or more, so that the size of the meeting is without question one of our largest. The Secretary also would like to make a personal explanation: On account of illness during September and October, which kept him out of work six weeks, and also a change of clerks, some mistakes occurred in the sending out of notices, for which the Secretary asks the indulgence of the Association. By the

request of the Council, a committee composed of Dr. Thomas S. Cullen and your Secretary was appointed two years ago to dispose of volumes of *Transactions* which the printer has on hand. There are, I think, 17 complete sets from the beginning of the Association and a number of other volumes which can now be obtained by the Fellows of the Association at the price of two dollars each, the regular price being about four dollars. This Committee first gave the opportunity to the Council to obtain what copies they desired, and now extends the same privilege to every Fellow of the Association to complete his files. All you have to do is to write to Dr. Cullen or to the Secretary and the matter will be attended to."

The Secretary then presented the report of the Council as follows:

Report of the Council

1. The Council unanimously adopts the resolution in regard to the Senior Fellowship, which had to lie over for one year, and presents it to the Association at this time for action.

A Senior Fellowship list as proposed is set forth in the accompanying amendment to the Constitution: "Any Fellow who has held Fellowship for twenty years or more may become a Senior Fellow upon application to and recommendation by the Council and election by the Association. Senior Fellows will be exempt from the payment of dues, but shall not have the privilege of voting or of holding office."

2. It is recommended that Dr. Miles F. Porter, Fort Wayne, Indiana; Dr. C. A. L. Reed, Cincinnati, Ohio; Dr. F. F. Simpson, Pittsburgh, Pennsylvania, and Dr. Hugh H. Young, Baltimore, Maryland, be put on the Senior Fellowship list if they so desire, and that Dr. Mack Rogers, Birmingham, Alabama, be dropped from the roll on account of nonattendance.

3. The appointment of the following Fellows is made at the request of the American College of Surgeons to serve on the Board of Governors: Joseph A. Danna, New Orleans, Louisiana; A. Johnston Buist, Charleston, South Carolina, and John S. Helms, Tampa, Florida.

4. Thirteen vacancies have been created by the retiring of four Fellows to the Senior Fellowship list, the dropping of one, and on account of deaths and resignations. Four Fellows have died during the year: W. P. Carr, Washington, D. C.;

W. R. Jackson, Mobile, Alabama; E. K. Cullen, Detroit, Michigan, and W. B. Platt, Baltimore, Maryland.

The resignations of four Fellows are accepted: M. H. Fletcher, Asheville, North Carolina; Reuben Peterson, Ann Arbor, Michigan; John G. Earnest, Atlanta, Georgia, and William H. Doughty, Jr., Augusta, Georgia.

The deaths of two Honorary Fellows are to be recorded: Hugh M. Taylor, Richmond, Virginia, and Herman Tuholske, St. Louis, Missouri.

To supply these vacancies the following are recommended for Fellowship:

W. B. Russ, San Antonio, Texas; Donald Guthrie, Sayre, Pa.; F. W. Rankin, Louisville, Ky.; George J. Heuer, Cincinnati, Ohio; D. W. Barrow, Lexington, Ky.; Daniel F. Jones, Boston, Mass.; W. F. Shallenberger, Atlanta, Ga.; William R. Cubbins, Chicago, Ill.; John L. McGehee, Memphis, Tenn.; J. H. Culpepper, Norfolk, Va.; Charles Farmer, Louisville, Ky.; F. Webb Griffith, Asheville, N. C.; Isidore, Cohn, New Orleans, La.

5. It is recommended that the next place of meeting be White Sulphur Springs, West Virginia, at the Greenbrier Hotel, and that Dr. Hugh H. Trout, Roanoke, Virginia, be Chairman of the Committee of Arrangements.

6. The following officers are unanimously nominated and recommended for election: President, James F. Mitchell, Washington, D. C.; Vice-Presidents, Irvin Abell, Louisville, Kentucky, and Battle Malone, Memphis, Tennessee; Secretary, Hubert A. Royster, Raleigh, North Carolina; Treasurer, Urban Maes, New Orleans, Louisiana; Member of Council, C. Jeff Miller, New Orleans, Louisiana. All of which is respectfully submitted,

W. D. Haggard,
Willard Bartlett,
Randolph Winslow,
Lewis S. McMurtry, *pro tem.*,
Bacon Saunders, *pro tem.*,
Council.

The President: The first item in the report for the Association to take action on is the Constitutional amendment. This amendment is intended to make way for younger men to become Fellows of the Association. While we have a great many active men who have served more than twenty years,

this arrangement permits of their still being active in the Association and of making room for younger men to join the Association. The Senior Fellows are exempt from the payment of dues, but do not have the privilege of voting or of holding office.

Dr. J. Garland Sherrill: I move that the resolution be adopted as read. Seconded.

Dr. Rufus B. Hall: I have been a member of the Association for thirty years and have been active in attending the meetings. Personally, I do not think it is right to shelve the older members and deprive them of the privilege of voting and of holding office, although I am not seeking any office. While I would like to see the amendment to the Constitution adopted, before doing so I think it should be amended in such a way that Senior Fellows will have the power of voting and of holding office.

Dr. Randolph Winslow: This matter came up in the Council, and it was not acted upon because it would throw the amendment to the Constitution back another year. The Council considered what Dr. Hall has just said and was itself in favor of modifying the amendment, but did not do so for fear it would cause the amendment to be postponed for another year.

If in order, I would like to amend the resolution as presented.

The President: The Chair would rule that would not be regular, and that an amendment to the resolution offered would force the resolution to lie over another year. If it is the wish of the Association that this resolution be passed as it stands, then a motion to give the Senior Fellows voting power can be passed on next year as a separate resolution. That would be regular, according to parliamentary rule; but if we amend the resolution and vote on it, it will postpone the entire matter for a year and would hold many of the active younger members back for another year. I understand that there are several Fellows who desire to be transferred to the Senior List, and it would simply mean another year of delay. The Chair would suggest the adoption of this resolution as it stands and has stood for a year, and if the majority of the Association wish that active voting power be retained by Senior Fellows, that part can be restored when the resolution is passed on a year hence.

Dr. John Wesley Long: This is not a personal matter with me, because I could not be made a Senior Fellow, inasmuch as I am an Honorary Fellow, with the privilege of holding office

and voting power retained. This whole question revolves upon one thing, namely, do we wish to have Senior Fellows of this Association, or do we wish to shelve them and say to them, You get out of the way and let the younger fellows come in? That is the milk of the cocoanut. I am in favor of this classification of Senior Fellows, if it is so desired, but I am opposed now and ever shall be to taking away the prerogatives of the men who have borne the brunt and the burden of this Association. If you want to make Senior Fellows, do not say, You shall not hold office or shall not vote. I am opposed to the resolution as it now stands.

Dr. John T. Moore: I believe if the Chair will refer to Robert's *Rules of Order*, he will find that we can make an amendment to this resolution at this time. I agree with the resolution in the main, but I also agree with those who have preceded me in the discussion. I believe it is germane to offer an amendment to the resolution at this time to carry it forward.

The President: We can only do this by suspending the rules by unanimous vote.

Dr. E. D. Martin: A member can be transferred to the list of Senior Fellows on his own volition, the only difference being he is exempt from the payment of dues. Certainly, any man who wants to remain active in this Association and take part in its proceedings ought to be willing to pay dues. Therefore, I think the amendment should go through as it is.

Dr. John C. Oliver: This same subject came up in the American Surgical Association several years ago, and the same arguments were advanced then as have been advanced today. In the American Surgical Association the only difference between a Senior and Active Member is that the Senior Member does not pay dues. The object of Senior Fellowship is to prepare places for the younger men who are striving to become members, and it is not so much to retire the older members. The resolution as presented in the Report of the Council will destroy the effect we want to produce. It would be better and make more certain places for the younger men if the resolution is modified simply to exempt senior members from the payment of dues and grant them all other privileges of the Association.

The President: The only way by which this can be done is by suspending the rules, and this requires a unanimous vote.

Dr. John T. Moore: I move that the rules be suspended. Seconded and carried.

Dr. Moore: I now move that the resolution as presented be amended to read that "after twenty years Fellows may be placed upon the Senior List without payment of dues."

The amendment of Dr. Moore was seconded by several, and on being put to vote was declared adopted.

Dr. Moore then moved the adoption of the resolution as amended. Seconded by Dr. Boldt and carried.

Dr. Herman J. Boldt: I move that the remainder of the Report of the Council be adopted as presented. Seconded and carried.

Dr. J. Garland Sherrill offered the following resolution:

Resolved, That the thanks of the Association be extended to the chairman of the Committee of Arrangements and his co-workers, and to the Fellows of the local profession in Memphis; to the hotel management; to the local committee of ladies; to the Drama League of Memphis; to the various clubs of the city, and to all others who have contributed to our comfort and entertainment at this meeting.

Seconded by Dr. Irvin Abell, and carried unanimously by a rising vote.

The President: Before we proceed with the scientific program, I am going to ask Drs. Downes and Trout to escort the new President to the platform.

President Miller, in introducing his successor, said: I can only say, Dr. Mitchell, in turning over this emblem of authority to you (referring to gavel), that we appreciate the honor of having you with us in this capacity, and I wish for you the same support and hearty coöperation I have had during my administration.

Dr. Mitchell, in accepting the Presidency, said: "Mr. President and Fellows of the Southern Surgical Association: I suppose that a speech is in order, but I am so overwhelmed that I do not know what to say. I never expected or dared to hope for this honor, which I consider one of the greatest honors the profession of this country has to confer. I feel very much in the same position I felt as a youngster once, when I had been grinding away for several years in a hospital with an object in view, and suddenly one day I met my chief (Dr. Halsted) in the corridor. He never promised anything or told us anything at any time. We met in a casual way in the corridor and he said: 'Mitchell, Cushing is leaving, and I

have taken the liberty of suggesting your name to the Board as his successor. The Board has acted favorably, and what have you to say?' All I could do was to look at the old gentleman and smile. He said, 'Say nothing—work.' I think that is the best I can do—say nothing and work.

"I must say, however, that I enter upon these duties with mingled feelings of joy and fear—joy, because I think it is one of the greatest honors the profession of this country can bestow, and fear because I have to fill the place that has been occupied by so many distinguished men. I see one here, my dear friend, Dr. Winslow, who gave me my first lessons in medicine. I think I have a hard task to fill. I thank you all. I appreciate the honor tremendously, and assure you that I shall work and do my best the coming year."

36. "Kielland's Operation for Prolapsus Uteri," by Dr. Herman J. Boldt, New York City.

The paper was discussed by Drs. Maury, Reder, Noble, Hall, and in closing by the essayist.

On motion, the Association adjourned until 2 P.M.

Afternoon Session. The Association re-convened at 2 P.M., and was called to order by the President, Dr. Mitchell.

37. "Growth in the Head of the Pancreas, Obstructing the Common Bile Duct and Descending Duodenum; Symptoms Relieved by Cholecystgastrostomy and Gastrojejunostomy," by Dr. William A. Downes, New York City.

This paper was discussed by Drs. Robins and Du Bose.

38. "The Results Obtained in Elephantiasis through the Kondoleon Operation," by Dr. W. E. Sistrunk, Rochester, Minnesota.

Discussed by Drs. Gessner, Royster, Reder, and in closing by the essayist.

39. "Four Cases of Femoral Aneurysm Successfully Operated On by the Matas Method," by Dr. Gaston Torrance, Birmingham, Alabama.

Discussed by Drs. Maes and Gessner.

As there was no further business to come before the Association, either scientific or otherwise, on motion, which was duly seconded and carried, the Association adjourned to meet at the Greenbrier Hotel, White Sulphur Springs, West Virginia, in 1923.

HUBERT A. ROYSTER, M.D.,
Secretary.

PRESIDENT'S ADDRESS

SOME TENDENCIES IN CONTEMPORARY MEDICINE OF SPECIAL INTEREST TO SURGEONS

By C. Jeff Miller, M.D.
New Orleans, La.

The Southern Surgical Association was founded thirty-six years ago, during one of the most eventful periods in medical history. The discoveries announced during the twenty years preceding its organization revolutionized the very foundations of scientific medicine, overthrew traditions and theories in force for generations past and ushered in the period of intensive scientific effort to adapt the newly proven facts to the alleviation of suffering and the prevention of disease. Cellular pathology, primary wound-healing, fermentation and immunity, bacteriology and a new conception of biology, the corner-stones of modern science, the priceless heritage of our age, were all promulgated within an incredibly short time. Just five years before our first meeting, Lister announced his discoveries which inaugurated the era of aseptic surgery. Just one year after our organization the Pasteur Institute was founded, for the further elucidation of the problems of fermentation and immunity.

It was during this period, when fundamental scientific discoveries were replacing ancient theories, that this Asso-

ciation was founded. Just how well it has fulfilled the purpose of its founders, that it should represent the highest efforts of scientific endeavor, is proved by a review of its *Transactions*. Its usefulness and influence have never waned. its advance has been constant and in the promotion of knowledge and good-fellowship among its members it has been at all times worthy of emulation. It is to this spirit I feel that I must attribute the honor and privilege of being your presiding officer, for only one who is filled with self-complacency can occupy this position without feeling humbled. The memories that gather about this chair appeal to me with oppressive weight and make it difficult for me to express my grateful appreciation of the honor you have bestowed and the confidence you have shown in electing me President of the Southern Surgical Association.

This society, however, being full of youthful vigor, finds more interest in prospect than in retrospect, and as the chief advantage of occasions such as this is the opportunity offered for the mutual interchange of thought and expression, not only upon purely scientific problems but upon those relating to the wider sphere of our activities, I have ventured to bring to your attention some tendencies and developments in contemporary medicine that may be profitably discussed by surgeons. Certain tendencies in medical education, the group study of disease, the coördination of specialties, the educational function of hospitals and some sociological and legislative problems are well worthy of our consideration.

Readjustment seems to be the order of the day in every branch of human endeavor, and surveys, with extensive dissemination of the findings, have proven the most effective means of accomplishing widespread reforms. This method of effecting needed reforms in our profession is one of the present tendencies in medicine, and the phenomenal success of the efforts of the American College of Surgeons to reform hospital administration through education of the public

and the profession is a striking illustration of the effectiveness of this new departure. Hospital standardization, which has been discussed as much and has accomplished as much as any movement in the profession in recent years, was accomplished largely because of the urgent need for reforms, but also because of the public interest aroused in the subject. The success of this movement has demonstrated that the public is keenly interested in medical affairs and will not remain indifferent to our requests for coöperation if the idea is presented in the proper manner.

With all of our discussion of hospital standardization, however, is it an established fact that we have a clear conception of what it means to each one of us personally? Just what do we really mean by standards? Are they elastic? Do they permit of alteration? Are they absolute or should they be of various degrees? A problem is half-solved when a correct definition of it can be formulated, and the stupendous task of hospital standardization was largely solved when the fundamental principles, the minimum requirements, were conceived and definitely stated. Our individual task, after all the larger one, is to emphasize and to insist that the fundamental rules were only minimum requirements, that the real structure to be built upon the skeletal foundations supplied by the American College of Surgeons rests with the individual and his coöperation with the personnel of the hospital staff. The College wisely recognized the relativity of standards, that they were elastic, that there could not be such a thing as an absolute standard, but it definitely fixed the minimum requirements.

Probably no greater medium for the general uplift of surgery and public service has been devised than the clinical meetings provided for in the hospital standardization scheme. Does not the crux of several of our vexing problems lie within the scope of the hospital staff and its clinical meetings? But these meetings will fail of their real purpose if they do not consist largely of analytical reviews of

the output of the hospital. Virchow once said that "medical literature was smeared over like flyspecks with case reports." They serve a purpose, but in this age of surveys we desire analytical studies of the hospital product, the inventory of end-results, the trial balance, if you please, the profit and loss of our clinical endeavor.

But before we can figure our end-results the final chapter of the case must be written according to a systematic plan. Under the present system our mortality may be fairly accurately obtained, but our morbidity cannot be estimated. Naturally, what the patient is most interested in is his physical limitations, his restoration to his normal health and his full economic capacity. To site a specific instance: a patient with a fractured femur leaves the hospital after a certain period of time, under a certain method of treatment, with no shortening and a united fracture. But how soon, under that method, is he restored to his full capacity for work? The hospital records do not show this, and only a systematic follow-up service can give us this information, without which the history of the case is certainly incomplete. Stock-taking, in other words, cannot be properly done without the final records, and our analytical surveys are correspondingly lacking.

Carrying hospital standardization just a step further, have we not also in the staff and the clinical meetings the medium through which the first practical step can be taken in the solution of one of the most serious problems now confronting the profession? Is this not the place to break the first lance in the attempt to curb the surgical tyro, reduce the percentage of unnecessary operations, discourage fads and check misdirected surgical enthusiasm? The real answer to this problem rests with the personnel of a staff, who possess a healthy interest in humanity and a broad conception of their responsibilities. National organizations can only mold opinion; their authority ends there.

One of our greatest tasks in this connection is the establish-

ment of the *average necessity* for a given surgical procedure. Just what is the average necessity for the performance of Cesarean section, breast amputation for benign lesions, laparotomy for so-called chronic appendicitis, and certain ill-defined pelvic operations? What better opportunity could be found for establishing this average necessity than is presented in analytical surveys, where a preponderance of such procedures would unmistakably stand out to confront the guilty offender and close the hospital to those who are indifferent to the disclosed facts? When hospitals adopt certain requirements and surgeons are accepted upon definite minimum requirements the staff should insist that only those who are properly qualified should practice in the institution. We should not and cannot wait for legislation to dissipate such evils, for our experience with such agencies has been far from satisfactory and the results may be wide of the correct solution. It is another problem that education alone can untangle. The impression must be banished that surgeons, like Topsy, "just grow," and there is no better way to initiate the movement than to close hospitals to the unqualified. A more auspicious time could not be found for inaugurating such a plan, since 83 per cent of the hundred-bed general hospitals in the United States and Canada are on the approved list.

Here too it is *apropos* to mention another shortcoming which is painfully apparent to those who have occasion to review records of different surgeons, namely, our woefully defective operation nomenclature. We have at last a standard nomenclature of diseases and pathological conditions, but not a standard operation nomenclature. The various terms used for expressing the operation of hysterectomy is a case in point. Without some standard no two surgeons can be sure that they are comparing the same processes, and hospital records are often worthless for the same reason. Furthermore, how can comparative studies of operative results in different hospitals be satisfactorily

made when there exists no uniformity in the method of accurately crediting a death to surgery or medicine? Some institutions follow the rule that all deaths following operation should be charged to surgery, regardless of the cause of death; others would credit death to surgery only if it occurred within a limited period, say two weeks, following operation. Such confusion makes comparison impossible, and, if results are given without note of this discrepancy, the statistics will be plainly unfair to a surgeon or institution. The importance of a uniform method is so obvious that it needs no elaboration. These are fair examples of some of our present problems of standardization, and they clearly illustrate two things: how much is still to be done along this line, and how closely intermingled are our community and our professional responsibilities.

No tendency of the present moment promises more for future achievements in medicine than the keen interest that is being aroused in graduate instruction. Our old methods are inadequate, lack a definite policy, and there were never any fixed standards for study beyond a period of attendance. Postgraduate schools serve a very useful purpose, but often do actual harm in arming an unqualified practitioner with a diploma for a course in some specialty with which he often deceived himself, but more often deceived the public. Specialists made in six weeks to three months by such a system have been largely instrumental in cheapening the title and have done great harm in creating gaps and causing loose coördination between the various specialities and the parent stems, medicine and surgery.

The most promising feature of the present movement is the conclusion that graduate instruction rightfully belongs in the medical school. Medical schools do not fulfil their obligations to the community simply by conferring degrees, and they are realizing that they have the additional duty of providing facilities for postgraduate instruction in the specialties as well as in research work. Such a movement

makes available the laboratories for fundamental branches, provides experienced instructors and reduces the necessary expense of independent postgraduate institutions. Methods of teaching undergraduate and graduate students do not differ so materially as to require necessarily a different faculty personnel, as has been so often emphasized.

Naturally the first step must be the standardization of the course believed adequate to equip a graduate in a given branch of medicine. This has already been largely crystallized in a tangible form by the Council of Education of the American Medical Association and the standardization policy of the American College of Surgeons. These two organizations can easily formulate a program that would inspire confidence in our resources and should receive our earnest approval. Moreover, we have already two institutions in this country, the Graduate Department of the University of Pennsylvania and the Mayo Foundation, that stand as pioneers in graduate instruction and may largely shape its future trend. This scheme can be modified to meet individual problems in medical centers. The movement is interesting to everyone holding hospital staff appointments, for the plan will demand ample clinical facilities and should eventually introduce teaching methods into the majority of approved hospitals willing to affiliate and adopt the necessary changes for such instruction. We should unqualifiedly endorse teaching in properly conducted hospitals and enlighten the necessary authorities as to its advantages. Osler very correctly said that the work of an institution in which there is no teaching is rarely first class. "It is, I think, safe to say that in a hospital with students on the wards the patients are more carefully studied and fewer mistakes are made. Without them there is neither the keen interest nor the thorough study of cases, nor amid the exigencies of a busy life is the hospital physician able to escape clinical slovenliness unless he teaches and in turn is taught by interns and students."

There will be an ever-increasing demand for medical teaching in non-university hospitals. It is hardly possible for graduate clinical teaching to be provided for to any extent in university hospitals, and such facilities must be chiefly found in non-university institutions. It will be easier to provide for such instruction since the authorities in charge of non-teaching institutions are rapidly realizing that medical teaching and research work are essential in all the higher types of medical practice. As a matter of fact, all hospitals are educational institutions in one way or another; it remains largely our duty to point out to the respective administration boards the advantage of systematic educational schedules, and the necessity of such affiliation with medical schools in such ways as will allow of a course with the requirements sufficient to qualify aspirants in the specialties, as well as short periods of study for those desiring simply a review in their respective fields. A vast field, therefore, lies open for cultivation in non-teaching hospitals, but it will require foresight and well-directed energy on the part of the profession and educators to turn these opportunities into a profitable educational investment.

The growth of medical knowledge and the increasing number of sciences associated with it are steadily making the diagnosis and treatment of disease rest on collective rather than individual efforts. Group medicine, or the diagnostic clinic, is the modern conception of the best method of meeting this need. It is the natural outgrowth of specialism and is unquestionably a distinct advance in contemporary medicine. Its usefulness, as demonstrated in the greatest clinic of the modern age, the Mayo Clinic, where may be witnessed a perfectly functioning organization with admirably coördinated departments, has stimulated the adoption of the method throughout the country.

The spirit is commendable, but the numerous modifications of the original clinics all too soon showed that group practice may be a possibility for evil if such groups are not properly

organized and if the members composing them do not reflect the highest ideals of professional ability and acknowledged skill in their respective departments. Recognizing their vast possibilities for good, we should encourage the formation of such clinics, but at the same time we should urge some standard for membership and insist that they should represent what such a clinic is really intended to be, an organization for the study and diagnosis of obscure disease. A group should pivot around an internist of acknowledged ability, a man with a broad knowledge of medicine, who is capable of properly allocating the special studies, a kind of denominator, who must assume the large responsibility of the final analysis and who will appreciate the importance and justice of coöperating with the general practitioner.

What is to be the surgeon's position in a medical group? Is he to be the inherent factor, the guiding spirit, or an adjunct for his diagnostic skill and his knowledge of surgical results? Too many groups are already showing glaring misfits and lack of proper coördination, proving themselves associations obviously formed for the exploitation of one or two members, usually a specialist or surgeon, the real diagnostic duties devolving upon men by no means always qualified for such responsibilities. A group under such circumstances becomes as "the tail to the kite" of some dominating personality, who, if lacking in the qualities necessary for such complex responsibilities, can easily pervert a splendid principle to selfish ends.

Most probably experience will eventually prove that the best field for group practice will center about the hospital, where ample laboratory facilities exist, the personnel being selected from the hospital staff, and the group made sufficiently elastic to prevent certain objectionable features that would seem so likely to arise in the average private clinic conducted apart from such an atmosphere.

Group clinics should receive our hearty approval, but our disapproval should be just as emphatic when they fail in

their interpretation of the real meaning of collective investigation. Division of responsibility is the one weak feature of group medicine, and it can be avoided only by careful selection of the group constituents. We should encourage sentiment against any compromise short of the acknowledged experienced consultant and thereby avoid exploitation of one of the most potent factors for good that has been given contemporary medicine.

A notable tendency about which there exists reason for serious discussion is the rapidly growing sentiment of accepting laboratory diagnosis and the scant attention given to clinical research based upon experienced observation. There is an honest conviction among many that clinical observation is untrustworthy because of possible inaccuracies. The multiplication of special laboratories has been almost bewildering. They have become necessary in the course of the development of modern medicine, but is it not possible that some confusion has occurred as to how much of present-day laboratory equipment belongs in the research department rather than forms a necessary adjunct of the clinician? To condemn laboratory facilities would be absurd, for we promptly acknowledge their present importance and willingly admit that most of the surgical problems before us will be solved in the laboratory in conjunction with the clinician instead of in the operating room. That our sense of proportion has been dimmed, however, by the undue emphasis on laboratory tests cannot be questioned. The best proof of this is that we really have but a few tests that are pathognomonically diagnostic, and practically none that will point out the combined cause, location and degree of functional impairment.

The human equation enters into laboratory diagnosis probably to as great an extent as into clinical observation, a point too frequently ignored. Even pathology seems to have suffered a partial eclipse in the present attempt to apply the sciences to diagnosis. Measuring functional

impairment seems to be of greater importance than structural changes, and bizarre tests, based upon faulty physiological premises, rapidly disseminate in the literature to the confusion of the clinician. One great danger of such a profusion of methods is that there will almost surely develop slovenly methods of their application, since many of them are essentially technical, and too much confidence will be placed upon mere routine tests. Sir James McKenzie warned against this when he very correctly said that a hundred new methods of investigating disease in the living increased by just that number the chances for going astray.

It must not be inferred that this is aimed as criticism of these valuable aids and efforts of laboratory workers. To the contrary they are essential, but the point to be emphasized is that they are only aids and adjuncts, not finalities, and are to be checked, questioned, rejected or proven correct in conjunction with intelligent clinical observations. We argue not against laboratory diagnosis but against its misuse, its indiscriminate, overtime employment, often without the slightest clinical indication. How often do we see elaborate roentgen-ray investigations of the gastrointestinal tract advised in patients of extremely modest circumstances who present little more than a history of indifference to normal bowel function? This may arise from the confusion in the minds of clinicians as to the real value of the roentgen ray and other laboratory diagnosis; in the meantime it is the public that suffers and naturally complains of the expense of modern medical attention.

We must urge enlightenment on the true value of laboratory procedures that are really worth while; insist upon their allocation by experienced laboratory and clinical workers before undue emphasis is given them in general literature. This is the only way to avoid the inevitable confusion and short cuts to diagnosis that we all may be guilty of under the pressure of professional exactions. Let

us always be found defending the proposition that medicine is more than a science, that a skilful physician must be more than a scientist, that he must possess other knowledge that we usually refer to as the art of medicine or surgery, and that the possession of one without the other may be equally harmful. There is no need to take a pessimistic view of such tendencies; they are merely temporary stages in our evolution and will be finally adjusted by the acid test of experience.

This applies as well to the overshadowing influence of research work in the present day. The art of medicine has been eclipsed to such an extent that our medical schools promise to become a series of research laboratories, even with each clinical department directed by a full-time research worker, each functioning independently, necessarily duplicating efforts and very likely defeating their own ultimate end. We must not recognize independent specialties in science, for there is no one science independent of another. Huxley has well said that "a science is independent in the proportion that it is imperfect."

It is utopian to believe that such an aggregation as a modern medical school demands could function to the best advantage and serve the final purpose for which it was created, namely, to supply the public with safe and intelligent practitioners, if the institution becomes largely a research laboratory. The true place for medical research is a fully equipped department, closely allied with the fundamental branches, but more closely coördinated with the clinical branches, easily accessible to the hospital, where clinicians and scientists may exchange their mutual problems and be equally conversant of their efforts and their limitations. After all, it would seem that many of our problems are largely the result of lack of coördination of departments and specialties, too great a tendency to draw close lines of contact and too little knowledge of the funda-

mentals upon which a top-heavy structure of specialties has been reared.

The steady trend of contemporary legislation will very soon force the medical profession to realize that we have been neglecting our opportunities for molding public opinion by not participating in the shaping of legislation dealing with health and other matters about which we have the only real knowledge and upon which we should have a patient hearing.

We have at present only two physicians in the United States Senate, and there is a proportionate paucity in the House of Representatives. Does this mean that we are really lacking in the spirit of citizenship, or do we fear that by having a healthy interest in the actions of public officials we are laying ourselves open to the suspicion of being politicians?

Groups of problems which have their genesis in social democracy, perhaps the most powerful factor in modern civilization, will present many features that have direct contact with our professional aims and ideals. Workmen's compensation is already established; health insurance is being seriously considered by several states; provision for maternity service is already a national enactment; child-welfare work and industrial medicine are making rapid progress, and some states are spreading clinical instruction through organized channels. We need legislative representation when agitation of legalized, socialized medicine is being widely discussed, when there seems to be a distinct possibility that attempts will be forthcoming to make medicine a governmental function, which would naturally carry with it governmental authority to barter individually or collectively for professional services. The discouraging tendencies of such a situation finds a striking example in the instance of some of our foreign confrères.

The most promising sign of the times, however, is reflected

in the willingness of the laity to participate in health programs, to listen to public addresses on medical subjects and to read, with eagerness, properly prepared health propaganda published in the lay press. Herein rests our opportunity to place before the public our needs and to enlist their support in favor of our educational policies. There still lingers in the minds of many laymen the impression that medical schools are a source of profit to those conducting them. We appreciate the passing of the old régime, but only a comparatively few can appreciate what has replaced it. The majority of our schools must depend upon state aid. A community must be capable of appreciating honest effort and scientific advances before it is willing to contribute or to be taxed for the maintenance of a modern medical school.

Oliver Wendell Holmes once said that a patient was no more entitled to know all that the doctor knew about his disease than he was to all the pills in his saddle-bags. This was fairly true of his age, but it is not true now that we have accurate facts to substantiate our statements. He also said, in connection with the confidence of the public in medicine, "There is nothing men will not do, there is nothing they have not done, to recover their health and to save their lives. They have submitted to be half-drowned in water, half-choked with gases, to be buried up to their chins in earth, to be seared with hot irons like galley slaves, to be crimped with knives, like codfish, to have needles thrust into their flesh and bonfires kindled on their skins, to swallow all sorts of abominations, and to pay for all of this, as if to be singed and scalded were a costly privilege, as if blisters were a blessing and leeches were a luxury. What more can be asked to prove their honesty and sincerity?"

This apt quotation simply emphasizes the fact that our problems are essentially educational. To accomplish our professional ideals we must have behind us the tremendous

power of public opinion. This we may have by taking advantage of every opportunity to disseminate useful knowledge to the public at large. This is the only medium by which a credulous public can be steered clear of pernicious cults and quackery, and our own profession purged of certain undesirables. If we enter into that movement with the proper spirit, keeping our personal aims subservient to proven facts and illustrating by honest endeavor our faith in our ideals, we shall not find the public lacking in encouragement and financial aid in our efforts in behalf of medical education and a more efficient medical profession.

GENERAL PLASTIC SURGERY

By John Staige Davis, M.D.
Baltimore, Md.

The title "General Plastic Surgery" is used because I desire to impress upon the Association the fact that plastic surgery should be visualized and taught as a whole, and not be thought of from the viewpoint of any of its subdivisions. Considerable misapprehension exists as to the scope of plastic surgery, the training necessary to do this work properly, and the type of man who can do it best. I hope that the following remarks will make these points clear.

Plastic surgery is that branch of general surgery which deals with the repair of defects and malformations, whether congenital or acquired, and with the restoration of function and improvement of appearance. Its field extends from the top of the head to the bottom of the foot, and the deformities dealt with, in most instances, involve the skin and adjacent soft parts and sometimes the framework (especially of the face) supporting these parts.

During the World War (1914 to 1918) plastic surgery was arbitrarily limited by military regulation to maxillofacial reconstruction, and it is my opinion that this was a great mistake and showed a profound lack of knowledge of its scope. Facial plastic and oral surgery is a very important part of the subject, but I wish to emphasize that it is only a part of plastic surgery, and that plastic surgery of the trunk and extremities is as necessary and equally as important. The results may be less spectacular, but they are

just as vital to the patient. For a number of years, as I have become more and more familiar with the intricacies of the subject, I have urged that plastic surgery be split fromthe general surgical tree and made to rank with such branches as orthopedic surgery or genitourinary surgery. It has been difficult to convince the "powers that be" of the necessity of this, but the great popular interest in the subject during the war, and the fact that surgeons had to be specially trained in order to give the best results to wounded men requiring reconstructive work on the face, has had some effect, even on the most hidebound.

Plastic problems of the trunk and extremities differ materially from those of the face and also require special study. When, therefore, it is realized that there is as much plastic work necessary to be done on these parts as on the face, it must be admitted by the ultraconservative that the whole subject is one which demands special consideration. I have heard the remark, "that now the war is over there will be no more plastic cases and no more use for plastic surgeons." This, of course, is simply an example of the general ignorance of plastic conditions, as there are always a great many cases in civil practice which require the special care of the plastic surgeon. For the most part they are old defects caused by disease, trauma, burns and necessarily mutilating operations, and also certain congenital malformations.

When the World War began, with the exception of the late H. Morestin in France, and one or two others elsewhere, there were no trained and thoroughly competent *general plastic surgeons*. I use this term to distinguish the few surgeons who have given special attention to plastic problems of the entire body from those who have confined their plastic work to facial reconstruction of one sort or another. There are comparatively few men at the present time who could fully qualify under this term. However, I hope that within the next few years there will be a trained general

plastic surgeon in every great hospital who is capable of dealing with the plastic problems of the trunk and extremities as well as those of the face.

When men requiring maxillofacial reconstruction began to come in from the front and were referred to the "Head Section," it was soon found that there were no surgeons available who knew what to do for them. Therefore, certain men were assigned to this special branch, many of whom had previously confined their practice to eye, ear, nose or throat surgery or to dental work. The majority of them, I venture to say, had never done a plastic operation before the war began, and few had had a general surgical training. In consequence they knew nothing whatever of the subject, even from a surgical standpoint, so had to begin from the beginning, trying out and discarding method after method, until they found procedures which were practical. The opportunity of taking care of great numbers of facial defects during this time developed a number of extremely skilful and able men in this branch of plastic surgery, and they have done magnificant work. Few of them knew even its principles to begin with, so of course had little knowledge of the literature of the subject. In consequence, discoveries and new methods have been reported, many of which are either modifications of some well-known method or rediscoveries of methods long familiar to the general plastic surgeon. As a matter of fact, in spite of the vast amount of material available, there have been remarkably few really brand-new methods developed in plastic surgery during the war, except in the treatment of those defects associated with fractures and loss of substance of the jaws. In the care of these cases it was soon found that the coöperation of the skilled dental surgeon was essential. The true plastic problems in military surgery were found to be much the same as those which had been solved in civil practice.

I am impressed each time I go through the wards of any

large hospital by the fact that there are cases on every surgical service, both general and special, which require the help and knowledge of the general plastic surgeon. These cases in the majority of instances are simply being carried along. I feel sure that the chiefs of the various services in every hospital would welcome the help of the general plastic surgeon and his organization as soon as they realized what could be done for these difficult and trying cases, or at least they would be glad to "pass the buck" to the plastic service.

In the military service, in time of war, it seems to me that all cases requiring plastic work, irrespective of the location of the lesion, should be placed in hospitals established especially for general plastic surgery. If this could not be done, then the most effective way of taking care of these cases would be to have a general plastic service in every general hospital, under a properly trained man, to which all plastic cases should be transferred, regardless of the service on which they were originally admitted.

I can say, from my personal experience, that there is very little likelihood of encroaching on other surgical fields. The majority of cases which come to me are referred either by general surgeons, orthopedic or genitourinary surgeons, ophthalmologists, rhino-otolaryngologists, obstetricians and dermatologists. Sometimes the gynecologist will also ask for help in cases in which the transplantations are of a type with which he is unfamiliar. So it can easily be seen that plastic surgery, instead of taking away something that the other branches want, is simply helping them out and closing a gap in the art and science of surgery hitherto unfilled.

Proficiency in plastic surgery, like every other special branch of surgery, can be obtained only by long and varied experience, and there is no short cut possible, although much time can be saved by proper instruction. In fact, this branch is particularly tedious, as the results in many

cases are obtained only after numerous operations, extending over long periods of time.

The teaching of this important subject has been neglected everywhere, and there is as yet, as far as I know, no department equipped for the proper instruction of plastic surgery as a whole in any American or foreign university. In fact, in many class "A" medical schools the subject is hardly mentioned, if at all, in the surgical course. The ignorance of the profession at large as to the scope and possibilities of plastic surgery is appalling, and no medical school has the right to graduate doctors without some instruction in this subject.

How is the best way to go about the teaching of plastic surgery? My experience when dealing with students is to carry out a program somewhat as follows: During the third year give a short series of lectures which in a general way will cover the entire subject. This is best done with the assistance of numerous lantern slides, to illustrate plastic problems and the procedures used to solve them. Didactic lectures in surgery are of little value as a rule, but the excuse for this series is that it will show the students the scope of plastic surgery as a whole and give them an opportunity of knowing what can be done in this field. During the fourth year, plastic surgery should be given as an elective course, and those interested in the subject should be given every facility in the plastic clinic of the outpatient department to study the treatment of wounds and carry out the various simple plastic procedures which can be done there. During this trimester the fundamentals of plastic surgery should be systematically taken up by means of conferences and demonstrations on patients. All the cases which require hospital treatment, and which are admitted through the plastic clinic, should be carefully examined, the possibilities discussed and the methods of treatment explained. When these cases come to operation the students should be present and should be able to follow

the after-treatment in the wards. Even the little the students get in the elective trimester is of great advantage to them in whatever branch of work they subsequently take up, as they seem to absorb something which is lacking in the other surgical courses. I say this advisedly, as many of the men who have taken this course tell me that it has been of the greatest help to them in their work after graduation. An adequate number of ward beds in the hospital should be assigned for the plastic service, and as many house officers as are needed. These house officers should be selected from graduates of class "A" schools who are interested in the subject. They should assist in the operating room on plastic cases and in due time should be given operative work under supervision. They should look after all plastic cases in the hospital, conducting the postoperative treatment and dressings under the personal direction of the plastic surgeon in charge. The house officers should also serve in the plastic clinic of the outpatient department.

A service of this kind would be of great use to a man going into other branches of surgery, as it would give him a point of view and a knowledge of the shifting and handling of tissues, and of the treatment of wounds, which at present is unavailable elsewhere.

It is now a generally accepted fact that "an adequate practical training in the principles and practice of general surgery" is necessary as a preparation for any real surgical specialty. This is particularly important for one who desires to specialize in plastic surgery, and consequently makes its final teaching a postgraduate subject. Postgraduate students should be carefully picked, and only those who show special aptitude for the work should be allowed to take the course, as it is impossible to make a plastic surgeon out of a man who has no flair for it. The postgraduate student should have the opportunity of working in the outpatient department, the privilege of the operative clinic, with the expectation of assisting the operator

and receiving personal instruction in operative technic, and eventually be allowed to operate under the eye of the chief. He should have the privilege of following the cases in the wards and of studying postoperative treatment, and the chance for clinical and experimental research on plastic problems. He should have the facilities to study the pathological material removed at operation. Men of special ability should be taken into the house on the plastic service and be given every opportunity to develop. The course should be at least one year and preferably two.

Instruction in plastic surgery on the cadaver, except for anatomical relationships, is of little value unless the student understands the circulation of flaps, the behavior of scar infiltrated tissue and the various problems of skin, fat, fascia, bone and cartilage transplantation.

Operative work in plastic surgery is of great importance, as it is in every branch of surgery, and should be carefully taught. However, in this work too much emphasis cannot be laid on the cultivation of sound surgical judgment and on the importance of careful examination and study of the various possibilities and procedures which may be beneficial in each individual case, as it is seldom that we find two cases exactly alike in plastic surgery. An unnecessary or ill-considered operation may completely eliminate the chance of a good ultimate result, and it is the ultimate result we must plan for and not the immediate relief of the condition. I have seen, and I am sure that many who hear this have also seen, plastic operations done by splendid general surgeons which seemed perfect when they left the table; but those of us who have been able to follow some of these cases afterward can tell of complete failures, and the suffering and prolonged convalescence of the patients and of resulting conditions even worse than before operation. This can be accounted for in many instances by the lack of judgment and training in plastic problems and by the desire to do too much at one time. When such cases do

finally drift to the plastic surgeon, he is terribly handicapped by the fact that all the tissues which might have been used to advantage have been wasted and by the lowered resistance of the patient. I know whereof I speak, for many of these cases come to me, and I have even witnessed the original operation on some of them, and felt sure when it was done that it would be a failure.

I do not want you to understand from what I have said that the plastic surgeon always gets a perfect result, as the man who never has a failure in any branch of surgery either does no work or stretches the truth. I do insist, however, that these difficult problems can best be solved by the trained plastic surgeon.

The knowledge of how to care for large unhealed defects and how to prepare them for contemplated plastic work is very important, although it has been said by those who should know better that the treatment of wounds is a waste of time for the plastic surgeon, and is out of his field. Of vast importance also is the proper preparation of scar infiltrated tissues and the encouragement of Nature, our greatest ally, to give us her generous help to a greater degree than usual, as attention to these details will often materially change the entire aspect of a plastic problem and give us a better result then could have been anticipated.

In addition to his other qualifications, the plastic surgeon must have originality and infinite patience; he must be an optimist, more or less an idealist, and he must have a far vision. He must also have a full measure of sympathy, as there is no branch of surgery, except possibly orthopedics, in which patient and surgeon come into such intimate contact, over such long periods of time, as in plastic surgery, and in which the personal element enters so much.

Until some such plan as I suggest is adopted, patients requiring plastic work cannot be given the best treatment, and little real progress will be made in the development of the subject. It will take years of plodding, as it has in the

past, for those interested to get the fundamentals of plastic surgery, while these can be taught in a reasonably short time in institutions properly equipped for the purpose.

I wish to reiterate that there is a crying need for a general plastic surgeon in every large hospital and also for the comprehensive teaching of plastic surgery in the medical schools. I feel this is bound to come. The question is, which school will see the light first and start such a course under the direction of a trained general plastic surgeon and provide him with every facility necessary to develop and teach this important and fascinating subject?

DISCUSSION

Dr. Francis Reder, St. Louis, Mo.—The question has occurred to me, What do we mean by plastic surgery? It is not in the full sense of the word a specialty, although the essayist designated it as such. Why should a student shortly after he has received his diploma from a medical college, presume to become a specialist in plastic surgery? It is true, after he has demonstrated that he can do surgery on the soft and osseous tissues, he may feel he is fitted for plastic work, but before he has given a satisfactory demonstration, we may assume that he is not fitted for that particular kind of work.

The physician who undertakes plastic work must have excellent judgment, he must have fought his battles in general surgery and his horizon must have become a broad one. He must be a man of unusual temperament; he must be a man well versed in the study of human nature, that he may be able to recognize patients suitable for plastic work. Without the coöperation of his patient, his results may prove very unsatisfactory. A surgeon who may not be successful in his work, in a general way, with the soft and osseous tissues, may take up plastic surgery and meet with success in this particular field of work.

AUTOTRANSFUSION

By Lucius E. Burch, M.D.
Nashville, Tenn.

Mr. I. B., aged fifty-one years. Occupation, farmer. Family history, negative. Marital history: Father of three children. His wife has had no miscarriages.

Previous Health and Illness. Usual diseases of childhood. In 1917, he had three chills in twenty-four hours. His physician diagnosed them as coming from the kidneys. In 1921, he had influenza, which was followed by a vesicular eruption limited to the upper left half of the body. He denies venereal disease; habits have been regular, digestion has been good. He has had frequency of urination for the last three months.

Present Illness. Sixteen years ago he was seized with an attack of bloody vomiting. Following this, he noticed the appearance of a lump in the left side. Five years later, he was seized with an attack of vomiting and, as he expressed it, passed blood and corruption both ways. The tumor became immediately smaller, but in a short time took on a rapid growth and attained two-thirds of its present size. He has had about one similar attack a year, followed by pain and tenderness over the tumor, and confining him to his bed for several days. In the intervals he has done hard manual labor. The tumor caused him little inconvenience, except when he leaned over. For the last two years he has been gradually growing weaker, and for the past two months he has been unable to work. The tumor has

increased noticeably in size, and he has swelling of the feet and ankles for the first time. He is forty pounds off in his weight.

The interesting points on physical examination were his protuberant abdomen, marked anemia and emaciation and expression of anxiety, reminding one of the *facies ovariana*. There were no enlarged glands. The heart was pushed up, with the point of maximum intensity just above the left nipple. A blowing murmur, systolic in character, was heard over the whole precordia. The mass in the abdomen was outlined as follows: Level with the nipple, the left axillary line passes downward under the xiphoid process, crosses the median line to a point $2\frac{3}{4}$ inches to the right and on a level with the umbilicus, then it passes downward to the left, crossing the median line 2 inches below the navel, goes across to the crest of the left ilium and then upward, filling in the flank and back to the point where it started. The mass is hard, and a distinct notch can easily be made out. It moves up and down with respiration and can be pushed over to the right side $1\frac{1}{2}$ inches from its normal position, and is dull to percussion. Urine negative, except for a few hyaline and granular casts. The blood shows the usual picture of severe secondary anemia: Hemoglobin, 35 per cent; coagulation time, 3 minutes; Wassermann, negative; malaria, negative. Roentgen ray shows a large mass in the upper left abdomen, extending downward and to the right. The kidney shadow is normal. Blood-pressure: Systolic, 128; diastolic, 88.

Preoperative Diagnosis. Splenic anemia.

The patient entered the hospital, August 18, 1922, and 750 cc of citrated blood were given, with a rise in the hemoglobin to 55 and a corresponding rise of the other elements. Two days after the transfusion the patient was taken to the operating room and the abdomen opened along the whole length of the left rectus muscle. There was a small amount of free fluid in the abdomen, and the spleen was

found to be densely adherent to all the surrounding viscera, as well as to the parietes of the left side and diaphragm. These adhesions were very vascular. The spleen was first detached from the diaphragm and the sides of the left abdominal wall, and hot packs were immediately placed in these locations. The other adhesions were then carefully tied and cut; the pedicle was doubly ligated and the spleen was removed. The operation was not only difficult but bloody. The patient's pulse was 72 at the beginning of the operation; at the time the spleen was removed it was 140. The large amount of blood that was lost in the abdomen during the operation was recovered by means of expressing the contents of the abdominal packs into a glass receptacle. A little over 800 cc of blood were recovered, and after this was citrated and strained it was injected into a vein at the elbow. The management of the blood and the transfusion were carried out by Dr. R. C. Derivaux, and by the time I had covered over the raw surfaces and closed the abdomen, he had almost completed the transfusion. At the time the transfusion was started the pulse was 140 and barely perceptible; at its completion the pulse was 102 and strong, and the patient's color was good. There was no reaction following the transfusion. Operative recovery was unusually smooth, and at the end of two weeks he was able to leave the hospital and return to his home. The spleen weighed 7½ pounds, and its measurements were 14 x 8 x 4 inches. The postoperative diagnosis was splenic anemia, which was confirmed by the pathological report.

The full details of this case have been reported for the reason that it impressed me as an ideal case for autotransfusion. I have used this procedure in 3 other cases successfully—2 of ruptured tubal pregnancy and the other a nephrectomy. I suggested autotransfusion in a discussion of a paper on ovarian apoplexy at the meeting of the Tennessee State Medical Society in 1920. At that time I was under the delusion that I was bringing out some-

thing new, but a search of the literature showed me that the Germans had been using this procedure since 1914. The abstracting and search of the literature was carried out for me by the research department of the American College of Surgeons, and it contains numerous articles of unusual merit and scientific interest.

Autotransfusion was first used by J. Thies in 1914. Since then 164 cases have been reported in European literature. Following the operation there have been 14 reported deaths —1 resulted from a technical error, 1 from hemoglobinuria and the remaining 12 were from postoperative complications or concurrent injuries. It has been most frequently used in Germany. Only 4 of the 164 cases were reported from outside of that country. The type of the cases was most frequently ectopic gestation, rupture of the spleen or liver and hemothorax. In only 6 cases was there a postoperative reaction. In cases of large hemorrhage in an infected field, A. Shafer has collected the blood and used it as a rectal enema, with very favorable results. It has also been given subcutaneously and intramuscularly. Zapelloni and Biser have used gauze to remove the blood. The other authors have employed vessels of various descriptions. It has been frequently commented on by many authors that blood in the pleura or peritoneum coagulates very slowly and may be used after a considerable time. Some authors seem to think that reinfusion has some hemopoietic action. The operation has been used by twenty-eight European surgeons. Only one (Opitz) advises against it.

Von Arnim[1] has used auto- or reinfusion in 12 cases. Saline solution was used with the blood in the proportion of two to three. Reinfused patients recover more rapidly than many patients in whom bleeding is not profuse. Of the 12 cases, 1 died, owing to a glaring blunder in technic and diagnosis.

Blechschmidt[2] reports 4 cases of ruptured tubal pregnancy, with no mortality. An addendum to the thesis states that

in the meantime 2 cases had been treated at the Zwickau Hospital, following rupture of the spleen, in which autotransfusion had been combined with extirpation. In 3 cases the loss of blood was more than 3 per cent of the weight of the body, so that a saline solution probably would not have sufficed. A review of the material shows that the reinfusion of even small amounts of blood, such as a fourth or a half of a liter, is beneficial.

Bumm[3] reports 13 cases of ruptured ectopic, with 1 death (the patient was practically moribund at the time of the operation); 2 cases had a chill and fever following transfusion. Bumm is of the opinion that the patient's own blood is superior to that of any donor.

Burchhardt and Landois[4 5] report 1 case which died as a result of a shrapnel wound of the spinal cord. The patient was temporarily much improved by reinfusion.

Burgkhardt.[5] This author emphasized that Thies originated this method and that Lichtenstein used it one year later. Thies was unable to report a large number of cases because of his work in the field.

Döderlein[6] reports 5 cases, with 1 death due to septicemia, which had no relation to the autotransfusion.

Eberle[7] reports 8 cases of ruptured ectopic with 1 death. Immediate effect of transfusion in the fatal case was good. In 4 traumatic cases there were 4 deaths. All were in a serious condition when operated on. Good effect followed the infusion in 2 cases. The author, in conclusion, says the problem of blood transfusion is by no means completely solved. Much is theoretical. Blood physiology, experimental surgery and hospital practice must progress considerably before a final judgment upon the procedure can be given.

Elmendorf[8] reports an interesting case of a soldier, aged twenty-five years, who was injured by an infantry shot in the right thorax. He collapsed immediately and was carried 300 paces to the temporary station. After watching

the case for one hour an ordinary infusion needle was inserted between the fifth and sixth ribs in the midaxillary line. By this means 100 cc of blood were withdrawn three times in the course of fifteen minutes and immediately injected into the arm. The blood was filtered through a compress and no coagulation was noted. At the beginning of the infusion 100 cc of normal saline solution was injected into the irrigator. Progressive improvement followed. On the eighth day the soldier was removed farther back from the front and on the fourteenth day was transported to a base hospital.

Fieber[9] reports but 1 successful case of a rupture of the spleen from a grenade wound.

Henschen[10 11] makes a complete review of the literature. No case reports. He recommends reinfusion in cases involving only moderate hemorrhage to facilitate recovery.

Kreuter[12 13] reports 1 successful case of rupture of the liver. Another case of rupture of the liver, with good results from transfusion, but the patient later died from concurrent injury. The author also advocates opening the saphenous vein in performing the transfusion.

Kulenkampff[14] reports 9 cases of ruptured ectopic and 2 cases of rupture of the spleen, with no statement of results.

Landgraf[15] suggests that autotransfusion be practised. He has had no opportunity to try out the suggestion.

Lawen[16] reports 3 cases of rupture of the liver from war wounds, with immediate good results, but the patients later died from concurrent injuries.

Lichtenstein[17 18 19] reports 25 ectopics, 8 cases, type not stated, with a successful result in all; 6 cases from war injuries with a mortality not stated. He also brings out the point, which is corroborated by a number of authors, that rather long intervals may elapse before unfitness of the blood for reinfusion need be feared.

Löhnberg[20] reports 14 successful cases. The quantity of blood injected varied from 500 to 1150 cc. It was maintained at body temperature, after defibrination, by stirring with

a glass rod, and was injected without being thinned. He is convinced that no other method can produce equal results.

Opitz[21] reports 1 case of somnolence, icterus and restlessness, not alarming, following autotransfusion. He advises against autotransfusion and will return to his old procedure of leaving the blood in the abdominal cavity, from whence it is absorbed rapidly.

Ostwald[22] reports 1 successful case of reinfusion following a ruptured ectopic pregnancy. He is of the opinion that in addition to neutralizing the low blood-pressure and increasing the amount of fluid in the veins, reinfusion returns to the blood a number of normally active erythrocytes and a serum adapted to the particular organism, with reference to protective substances and secretions.

Peiser[23] reports 1 successful case of rupture of the spleen.

Ranft[24] reports 1 successful case of rupture of the spleen from a grenade fragment.

Rietz[25] reports some interesting experimental work in animals.

Roedelius[26 27] reports 12 cases of autotransfusion used in ruptured tubal pregnancy. He states, however, that he is of the opinion that only 1 of the 12 cases reinfused would have died without this aid.

Schäfer[28 29 30] reports 4 cases following obstetrical accidents. In 2 of these cases blood was expressed from the placenta. In 1 case, on account of the blood being contaminated, he used it as a rectal infusion.

Thies[31] first advocated and used autotransfusion. He reports 3 successful cases of extrauterine pregnancy. All 3 patients, who had been pulseless, recovered and were dismissed seven days after the operation. Before this method was employed the blood in several other cases had been examined bacteriologically. It was always free from bacteria. Microscopically all erythrocytes were intact. No coagulation had occurred. The method is recommended

for cases that are pulseless and where the hemorrhage has occurred recently.

Töpler[32] reports 24 cases of reinfusion of blood in ruptured extrauterine pregnancy. He also quotes Schweitzer, who reports 1 death from hemoglobinuria.

Wederhake[33] strongly recommends autotransfusion in gunshot injuries to the lungs. With a hemothorax the blood was removed by means of puncture, filtered through a sterile cotton wadding and injected intravenously. It was always possible to dispense with the use of sodium citrate and with defibrination. Experience has shown that the blood of a hemothorax coagulates with difficulty.

Zapelloni[34] reports a successful case of reinfusion in a ruptured ectopic.

A review of the English literature shows only 2 cases, 1 by Ogilvie, of Guy's Hospital, and 1 by Sampson, of the General Hospital, Birmingham.

The American literature up to the present time shows very little on this subject. The author personally knows of a number of cases, however, that are to be reported in the near future.

Dr. Francis C. Grant[35] reports a very interesting case from the service of Dr. C. H. Frazier, of the University Hospital, Philadelphia. A suboccipital exploration was determined on. It had been their routine practice of late to transfuse postoperatively all cases upon whom a suboccipital exploration has been performed. The patient was large, stout and plethoric. 500 cc of blood were withdrawn and kept in 2 per cent sodium citrate solution in the refrigerator. Twenty-four hours after the withdrawal of the blood the operation was carried out and the patient's citrated blood was injected into a vein of the arm without reaction. The postoperative course was favorable. Grant suggests, in conclusion, that although the plethora and high blood-pressure seemed special indications in this case, autotransfusions might be considered in other conditions.

Dr. Murray B. Davis[36] reports a case of autotransfusion for gunshot wound of the spleen. The transfusion served an excellent purpose, but unfortunately the patient developed a bronchial pneumonia and died on the ninth day.

Levine and Segall[37] have a very interesting article on post-transfusion reactions. They bring out that a long operation in which ether is used as the anesthetic alters the patient's serum as regards its hemoagglutinin properties. This change is not a permanent one, but disappears during the first twenty-four hours after operation, *i. e.*, just before the time when the patient has recovered from the effects of the ether anesthesia. They conclude as follows: (1) The compatibility of the recipient's and donor's blood must be determined prior to each and every transfusion. (2) No transfusion must be done during or within twenty-four hours after prolonged ether anesthesia, even when the donor has been found suitable previous to the beginning of the anesthesia. If these conclusions are correct, and I am of the opinion they are, it makes autotransfusion a most valuable procedure in certain cases.

Conclusions. Autotransfusion is a safe procedure, although in a limited number of cases reaction will occur.

Sodium citrate is not essential. Normal salt solution will make an admirable substitute, and if neither of these are at hand the pure blood may be reinjected.

Extrauterine gestation will offer the largest field of usefulness for this procedure, but in wounds of the spleen or liver, wounds of the lung producing a hemothorax, and in operations where a large amount of blood is unavoidably lost, it will be found not only good to save life but to hasten postoperative recovery.

Contaminated blood should not be thrown away. This blood should be given as a rectal drip.

Autotransfusion may occasionally be used to advantage in certain obstetrical complications, such as placenta previa, rupture of the uterus and Cesarean section.

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THE INFLUENCE OF HEMORRHAGE ON THE MORTALITY IN GUNSHOT WOUNDS AND OTHER INJURIES OF THE ABDOMEN, WITH AN ANALYSIS OF 69 CASES

By J. M. Mason, M.D.,
Birmingham, Ala.

This paper is based on a study of 69 cases of abdominal wounds which have been treated in St. Vincent's Hospital, the Hillman Hospital and the Employees' Hospital of the Tennessee Coal, Iron and Railroad Company during 1921 and 1922, with a few cases late in 1920. 18 cases have been treated in my own service; 27 cases are from Dr. Lloyd Noland's clinic of the Tennessee Coal, Iron and Railroad Company Hospital and the remaining 24 cases have been in the services of Drs. Ledbetter, Drennen, Davis, E. P. Hogan, G. A. Hogan, C. H. Moore, H. L. Jackson and Wilder, my associates on the staff of the Hillman and St. Vincent's Hospitals, all of whom I thank for the privilege of making use of case records.

With the exception of three farmers and one railway shopman, the patients have been unskilled laborers or members of their families. There were 6 white patients and 53 colored. Altercations, assassinations or conflicts with officers of the law accounted for 52 cases, while 1 suicidal wound is noted and 6 were attributed to accident. The patients, as a whole, are of the most vigorous class of individuals, the greatest number being between the ages of twenty and forty years, while there were 4 children under twelve

years of age and 1 man aged sixty-three years. The cases were handled expeditiously, all but 4 reaching the hospital within a few hours of the time of the injury and undergoing operation without further delay than that necessary for examination, diagnosis and surgical preparation. As far as the records show, all operative cases except 7 underwent operation within eight hours after injury.

With these points in mind, I feel that we are dealing with a series of abdominal injuries on healthy patients, who should be the best possible surgical risks and who have been expeditiously treated, in well-organized hospitals, by skilled and competent surgeons, according to the best present-day surgical teaching. While the series is not large, the statistics give a fair indication of what is being accomplished with this class of patients in civil life. An analysis of the injuries sustained and the results obtained shows that the high mortality is not due to perforation or laceration of abdominal viscera, as all types of injuries were successfully treated by operation, but that it is due to the massive hemorrhage which is often associated with visceral injury. By early repair of the damaged viscera we save the patient from peritonitis, but, as the records show, we do not, with our present methods of treatment, compensate for the loss of blood which has taken place in certain cases.

TABLE I.—CLASSIFICATION ACCORDING TO CAUSE

Crushing injury (rupture of spleen)	1
Stab wounds	9
Gunshot wounds	59
Total	69
Deaths	41
Mortality	59.4

As stab and gunshot wounds present the same general type of injury, no attempt is made to provide separate statistical tables. Ordinarily, the stab wound is a less

serious injury than the gunshot wound, by reason of the more limited range of the knife as compared with the bullet. The one crushing injury in the series is included in the "large hemorrhage" group, and will be discussed somewhat in detail further on.

For purposes of closer study the cases are further subdivided as follows:

TABLE II.—SUBDIVISION INTO GROUPS

Group No. 1.—Large Hemorrhage Series

A. Cases not operated on by reason of collapse from hemorrhage when admitted:

		Cases.	Deaths.	Mortality, per cent.
Gunshot wounds	9			
Stab wounds	1	10	10	100

B. Operative cases; large hemorrhage with extensive visceral injury:

		Cases.	Deaths.	Mortality, per cent.
Gunshot wounds	24			
Stab wounds	2			
Crushing injury	1	27	24	88.8
Total	..	37	34	91.8

Group No. 2.—Small Hemorrhage Series

A. Operative cases; no material hemorrhage, extensive visceral injury:

		Cases.	Deaths.	Mortality, per cent.
Gunshot wounds	17			
Stab wounds	2	19	6	31.5

B. Explorations: Wounds nonpenetrating (5) or penetrating with no visceral perforation (8).

		Cases.	Deaths.	Mortality, per cent.
Stab wounds	9			
Gunshot wounds	4	13	1	0.76
Total	..	32	7	21.8

Looking into these groupings, we find in Group No. 2, B, 13 explorations with no visceral perforation and only 1 death. This death was in one of my own cases and resulted from pneumonia from injury to the right thorax, and should not be charged to the abdominal injury. The low mortality shows the comparative safety of such explorations. In Group No. 1, A, we find 10 fatal cases in such collapse on admission that no operation could be undertaken. This demonstrates the desperate state which is quickly reached when large vessels are injured.

A comparison of the operative cases in Groups Nos. 1 and 2 gives interesting and startling information.

The patients in both these groups received the same class of visceral injuries, as is shown in Table III. They were treated in the same hospitals, with the same expeditiousness, by the same surgeons and under identical surroundings.

TABLE III.—VISCERAL INJURIES SUSTAINED IN OPERATIVE CASES

	Large hemorrhage series.	Small hemorrhage series.
Cases	27	19
Deaths	24	6
Mortality	88.8%	31.5%
Perforation or laceration of:		
Bladder	2	3
Small intestine	14	10
Large intestine	7	5
Liver	7	3
Kidney	1	2
Stomach	7	3
Spleen	2	0
Mesentery	11	1
Simultaneous injury to other important structures:		
Spinal cord	1	0
Lungs and pleura	2	2

In one group we find a mortality of 31.5 per cent and in the other a mortality of 88.8 per cent. The one great

difference in the two groups is that, on the one hand, the visceral injuries are unassociated with any material loss of blood, while, on the other hand, we have the addition of massive hemorrhage.

Injuries of the abdominal viscera will always have a certain unfavorable mortality from peritonitis, obstruction, and other postoperative complications, but a consideration of the cases here presented shows that the extremely high mortality encountered is the direct result of hemorrhage, all the fatal cases in Group No. 1 except 8 dying within a very few hours, before sufficient time had elapsed for the development of fatal inflammatory or mechanical complications. The deaths, also, which took place later, were no doubt influenced by the lowered resistance from loss of blood.

All patients received the usual treatment for shock; namely, heat, opium, proctoclysis, hypodermoclysis, intravenous salines and various cardiac stimulants. That these remedies are entirely ineffectual in overcoming the effect of large hemorrhage is demonstrated by the mortality of 88.8 per cent.

The brilliant results obtained by transfusion in all types of acute hemorrhage teach us that, if we are to lower this high mortality rate, donors must be obtained and transfusion must be practised.

In only 3 cases of this series was transfusion resorted to, and one life was saved thereby.

The problem with this class of patients is the difficulty in securing donors. Patients are often friendless or out of touch with friends and family; such friends or acquaintances as sometimes accompany them are often ignorant, suspicious or afraid, and flatly refuse or disappear upon the suggestion that they act as donors. The patients and their friends are seldom able to pay donors for transfusion.

In the Hillman Hospital, which receives free patients from the city and county, in many years' service on the surgical

staff, I have been able to obtain only two donors for immediate transfusion, though on several occasions, when the emergency has not been so pressing, we have obtained suitable donors after some delay. Every hospital that undertakes to care for these injuries must be prepared to carry out, without delay, all the laboratory and operative detail of blood transfusion. This demands that the laboratory staff be ready for blood-matching at all times, and involves the typing of the blood of a large number of hospital employees who might consent to act as donors under certain circumstances.

The operating-room service and the surgical staff should be so organized that patients may be transfused with no further delay than that necessary for procuring suitable donors. This plan is in use in many hospitals that care for patients of better social and financial status, and while it will be difficult to put in operation with the cases under consideration, it should, nevertheless, be persistently attempted.

Transfusion should be considered as much a part of the treatment of these cases as the laparotomy, and when the surgeon and his staff consider the problem from this standpoint, an increasing number of donors will be obtained.

Autotransfusion. Autotransfusion or autoreinfusion of blood is a therapeutic measure of promise in a limited number of cases. This practice, introduced by Thies in 1914, and used first by Lichtenstein, in hemorrhage from ruptured ectopic pregnancy, was used in a small number of cases of traumatic hemorrhage in the recent war, and in a few cases from civil life.

Fieber,[1] Peiser[2] and Ranft[3] report successful autoreinfusions in ruptured spleen, 2 cases resulting from gunshot wounds and 1 from the kick of a horse.

Elmendorf[4] reports a successful autoreinfusion of 300 cc of blood drawn from the pleura following gunshot wound of the right thorax.

Kreuter,[5] [6] reports 1 successful autoreinfusion in rupture of the liver caused by the kick of a horse, also 1 unsuccessful case in gunshot wound of the liver. In the unsuccessful case he states: "The blood infusion was performed by an assistant during the operation. The patient was dying. The effect of the autoinfusion was marvelous. He recovered consciousness, but improvement lasted only a few hours. Autopsy showed that the patient died from progressive hemorrhage from an untreated wound of the kidney."

In hemorrhage from the liver or the spleen, and from the mesenteric or other vessels, unassociated with contamination from injury to intestinal or urinary tract, autoreinfusion is indicated and can be very easily carried out. In this series there were 3 deaths from injury to the liver where it could have been employed. In one case, rupture of the spleen, it could also have been used if a donor had not been at hand. The brilliant results obtained in this small series of traumatic cases, and in the more extensive experience of gynecologists, indicate that it is a therapeutic agent of great value in selected cases.

In the 69 cases of abdominal injury here reported, only 3 transfusions have been performed, one in Dr. Noland's clinic and two in my own service at the Hillman hospital. In Dr. Noland's case the patient was moribund following an operation for gunshot wound of the abdomen involving the liver. He did not survive.

In one of my cases, a gunshot wound of the liver and right lung, the patient died while transfusion was in progress, with symptoms of anaphylaxis, though the blood had been carefully matched in the laboratory.

My second case, rupture of the spleen resulting from a wagon passing over the body of the patient, recovered. I feel that the recovery of the patient was due directly to the transfusion. The case presents so many interesting points it will be briefly reported: At 8 A.M., July 8, 1922, the patient, a white boy, aged fifteen years, was run over by a wagon

loaded with lumbar. He was brought about twenty-five miles to the Hillman Hospital, where I saw him at 8.10 P.M. His temperature was $99\frac{4}{5}°$; pulse, 84; blood-pressure, D., 80; S., 115. Extensive abrasions were present over the entire back, most marked over the left lower ribs. There was no evidence of fractured ribs or of spinal injury.

His abdomen was rather rigid and there was generalized soreness, but no point of special tenderness. There was some suggestion of fluid in the left flank. The urine was free from blood. He was suffering some pain across the upper abdomen and in his chest, but was not shocked. His symptoms were so indefinite that we decided on further observation. The next morning he was again examined, Dr. E. P. Hogan being in consultation with me.

We found the temperature $96\frac{2}{5}°$; blood-pressure, D., 42; S., 66; pulse, 120. His abdomen was slightly distended and signs of fluid were definitely present in the peritoneal cavity. He was pale and sweating and complained of a feeling of great weakness.

We made a diagnosis of abdominal hemorrhage, from rupture either of the liver or the spleen. It was evident that he would not survive an operation in the condition he then presented. His father was found to be a suitable donor, so we decided on a transfusion, to be followed by operation under local anesthesia.

500 cc of citrated blood, together with 200 cc of normal salt solution, were given, and the blood-pressure rose from P., 42; S., 66 to P., 55; S., 80, with a corresponding improvement in his strength.

Under 0.5 per cent novocaine the abdomen was opened through a right rectus incision. The liver was found intact. A large intraperitoneal hemorrhage was present and the spleen was found to be badly lacerated. As removal of the spleen was impracticable through the right rectus incision, the line of anesthesia was carried across the abdomen to the

left. A transverse incision was made and the spleen was easily exposed.

Splenectomy was performed and the abdomen was closed with a cigarette drain.

The operation was carried out under local anesthesia, and the only pain complained of was that which attended the lifting of the spleen from its bed when the pedicle was clamped and ligated. He made an uneventful recovery.

The other spleen case of the series, a gunshot wound involving the spleen, the stomach and the right pleura, is in striking contrast to this. He died on the operating table from the effects of hemorrhage, to overcome which no donor was available.

Summary and Conclusions. 1. The mortality of 88.8 per cent in the "large hemorrhage series" as compared with 31.5 per cent in the "small hemorrhage series" teaches that our treatment of hemorrhage must be improved.

2. Transfusion must be more extensively employed.

3. Autoreinfusion should be practised in selected cases.

4. If cases are seen early and observation indicates that hemorrhage is not progressive, operation may well be deferred a short time, while waiting for reaction, and while efforts are being made to obtain donors for transfusion.

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DISCUSSION ON THE PAPERS OF DRS. BURCH AND MASON

Dr. Herman J. Boldt, New York City.—It is needless to say, these two papers are very instructive. I consider the suggestions made in Dr. Burch's paper calculated to stir up a class of patients upon whom we have looked heretofore as very unfavorable.

I am acquainted with the history of the cases narrated from the German literature and with the opinion of Opitz. If we contrast his opinion with that of numerous men who have used autotransfusion in the way it has been described by Dr. Burch, we know there are some men who would not recommend the method as superior to the leaving of blood in the abdominal cavity for rapid absorption. They will stick to that if they consider it equally good. Autotransfusion by the method described is necessarily superior to absorption of the blood. Furthermore, we do not know how rapidly blood is absorbed by leaving it in the abdominal cavity.

While I have had a fairly large number of cases where I have left blood in the abdominal cavity after extrauterine pregnancy operations, yet there was no way of knowing how soon that blood was absorbed and whether there was any residue left I do not know.

It seems to me, we ought to give autotransfusion thorough consideration and trial.

Dr. Harley R. Shands, Jackson, Miss.—I enjoyed Dr. Burch's paper very much, and after listening to him I received one idea which I think is worth mentioning.

I was forced to live in Colorado Springs for two or three years. There we very commonly resorted to artificial pneumothorax in the treatment of pulmonary tuberculosis and hemorrhage from the lungs. It has occurred to me that in injuries near the center of the lung, where there is much intrathoracic bleeding, the combination of autotransfusion with the induction of artificial pneumothorax might be a very valuable form of treatment. The blood could be aspirated from the lower part of the thoracic cavity, and at the same time air introduced higher up. This would keep the lung collapsed, substituting air for the blood. The blood could

be reintroduced into the vein after the manner suggested by Dr. Burch. Ordinarily, when artificial pneumothorax is induced for the treatment of pulmonary tuberculosis, we only give 300 or 400 cc at a time. In case of hemorrhage we have no hesitancy in giving 1500 cc at one injection.

If hospitals doing emergency work were provided with an artificial pneumothorax apparatus in their accident room and someone connected with the hospital should become familiar with the use of this machine, I feel that this form of treatment would prove to be a valuable means of meeting the serious emergency of a severe intrathoracic bleeding from gunshot or stab wounds of the chest.

I would stress the point, after having had considerable experience with the induction of artificial pneumothorax, that it cannot be successfully done unless one has the proper machine with which to do it. You should have a machine on which there is a gauge, so that the amount of air-pressure can be known. This machine can be installed for an expense of around $40. Any surgeon can learn the use of this machine very quickly.

I would like to ask Dr. Burch whether or not he thinks there would be danger in the reintroduction into the circulation of this blood from the chest when injury had been caused by a bullet or knife which, of course, could not be expected to be sterile. Of course, there would also be some danger of infection of this effused blood from the bronchial tubes. The point I would like cleared up is whether or not there would be serious danger of a general blood infection if this blood were aspirated very soon after the injury and reintroduced into the vein.

I feel confident that this idea is worthy of thought and development. At any rate, air which is innocuous would be substituted for the blood in the thorax. This blood often becomes infected, and if the patient survives, must be drained away later.

Dr. Robert Caldwell, Nashville, Tenn.—While I have had no experience with autotransfusion, the thought occurred to me that in the great majority of cases, especially in our ectopic cases, autotransfusion is not especially applicable because we need transfusion prior to operation, and possibly transfusion from a suitable donor would be a preferable procedure. In a case in which death is not imminent, autotransfusion would be a good procedure for the early recovery of

the patient. Autotransfusion has a limited field in a case where we have an alarming hemorrhage during an operative procedure. In that case there would be a quicker recovery of the blood, and autotransfusion in such a case would be more applicable.

Dr. Mason has brought us a very important lesson with regard to transfusion in hemorrhage cases, showing the greatly increased mortality in the severe hemorrhages, and if we transfused more of our cases that come to us in a desperate condition, we would have a lower mortality.

Dr. Francis G. Du Bose, Selma, Ala.—This is a most important subject, one from which we learn many things, and I am glad our attention has been called to it.

For many years we have been trying out different methods of transfusion for loss of blood following hemorrhage; there are many difficulties and disappointments. Autotransfusion is certainly worth while, provided it does the thing that ordinary transfusion has failed to do, and this is doubtful.

We have used citrated blood and direct blood transfusion, but the one big bugbear in the extreme cases, and one with which we have been unable to cope, is the failure in four or five hours of the individual to sustain the tempory stimulating effect of the transfusion. Lately, adrenaline chloride solution, from 10 to 45 drops, has been added to a solution of glucose and saline for intravenous administration in these extreme cases with dramatic temporary effect. In many instances there is the disappointing fall in blood-pressure, the patient going into collapse and ultimate failure. Rare, indeed, does one fail to get a temporary boosting from saline or blood transfusion; sometimes it does no more. While the transfusion is going on the patient comes out very well from the collapse, then begins to perspire, his blood-pressure gradually coming down and his pulse quickening in rate. In four or five hours another transfusion gives him another boost. This is particularly true when adrenalin solution is introduced toward the close of the effusion, giving enough to produce its full physiological effect, as evidenced by restoration of consciousness, a full, bounding pulse, a sense of fulness in the head and tightness in the chest. We have also given digitalis intravenously and pituitrin hypodermically in order to sustain increased blood-pressure.

I would like to hear from other members with reference to such additional measures as may have been used by them to produce a prolonged or permanent effect following the transfusion of blood or saline.

Dr. Edgar L. Gilcreest, San Francisco, Cal.—The blood-pressure should be an indication whether or not the patient will stand an operation. In France when a wounded soldier was brought in from battle, we took his blood-pressure. If it was below 100 we learned that an operation usually ended fatally. Instead of operating we gave him external heat and hot fluids to drink, and if the blood-pressure rose, we operated.

I was interested in hearing the difficulties of getting donors for these cases. We have worked that problem out very well in San Francisco by having the students of the University Medical School act as donors, giving them $25. In this way we have been able to obviate the difficulty of getting donors in these cases.

Dr. Albert O. Singleton, Galveston, Texas.—About two years ago I read somewhere in the literature of a case of ruptured extrauterine pregnancy that was transfused with the blood taken from the abdominal cavity. One month ago I had a patient suffering from ruptured tubal pregnancy who was in an extreme condition from the loss of blood, and I felt that this was a case in which I might attempt to do an autotransfusion. After opening the abdomen I dipped about 500 cc of blood with a cup, and with the citrate it was put back into the vein. She had an uneventful recovery, with no reaction following the transfusion.

Dr. Walter C. G. Kirchner, St. Louis, Mo.—I have been very much interested in this subject from the standpoint of emergency surgery. In emergency cases, gunshot wounds and the like, the patients die of shock, hemorrhage or sepsis. With a selected staff in this type of cases we can bring the mortality down to 35 per cent. Shock and hemorrhage have been the bugbears in emergency work, and anything that offers a solution in this direction should be made use of. I have thought of autotransfusion as one of the means of aiding in reducing the mortality. I have not had an opportunity in the gunshot cases of using autotransfusion on account of

infected blood, but the suggestion to use this blood in the manner mentioned offers a solution, although rectal alimentation and rectal medication are not of as much value as we sometimes think. I have tried autotransfusion in ectopic cases, and recently a patient, nearly moribund, was brought in suffering from ectopic bleeding, and in her case autotransfusion was employed. The blood from the abdomen was dipped up, placed in citrate solution, given at once and the result was remarkable.

One of the chief dangers in these ectopic cases as well as in cases of emergency surgery is that the patient is operated on under unfavorable conditions. If such a patient be given ether anesthesia, shock is added to the already hazardous condition and things are made worse. If sufficient morphine be administered to give rest to the patient and control hemorrhage, a minimum amount of ether may be used and better results will be obtained. Bearing in mind the harmful effects of shock, the dangers of anesthesia and the advantages of autotransfusion, I think we will be able to lower the mortality rate.

In two other recent cases in hospital service, autotransfusion was successfully employed, and I believe the method offers a definite and valuable adjunct in emergency surgery, in rupture of the spleen or liver and in other cases in which the blood is not infected.

Dr. J. Garland Sherrill, Louisville, Ky.—I can see the value of this method of autotransfusion in cases of acute hemorrhage or hemorrhage from traumatic conditions. However, I cannot see the extreme value of it in cases of ectopic gestation. The mortality in cases of ectopic gestation is so low that I doubt very much whether it would be lowered any by the use of this plan of treatment. It is not a simple procedure devoid of danger, and if it were used in every case of ectopic gestation, I believe we would lose more women than by letting it alone.

This is an authoritative body, and our discussions when published carry great weight, and I believe we should be cautious in advising or recommending this plan of treatment in cases of ectopic gestation.

Dr. Burch has brought forward a means of treatment that can be employed in serious hemorrhage from the spleen. You may control hemorrhage of the spleen by taking the blood which has escaped into the abdomen and injecting it into the

vessels of the patient. Blood in the pleural cavity may be taken into a syringe and put back into the vessels of the patient. The bleeding vessel must be clamped promptly to control it. It is well to bear in mind that this method of autotransfusion is not such a simple procedure as would appear from the discussion, but it may prove dangerous in the hands of those who do not thoroughly understand the situation and are incapable of carrying out the technic. In the hands of a master surgeon it is undoubtedly a comparatively simple procedure.

Dr. William B. Coley, New York City.—While I have had very little personal experience with gunshot wounds of the abdomen, my interest in the subject was very much aroused by Dr. Bull's epoch-making contribution concerning a case in 1887 with four wounds of the small intestine. In 1888, I collected all cases of gunshot wound of the abdomen that I could find in the literature, and the mortality at that time was nearly 100 per cent.

It is important to know that the great advance in the treatment of gunshot wounds of the abdomen has been due almost entirely to American surgeons, and I know of no contribution more important than the one presented here this morning. I think hemorrhage as a cause of death is very important, and the method of transfusion that has been described will help us in getting better results in the future.

While this has been a world-wide problem, the European nations have looked to us for help in solving it, and the reason is not far to seek as the recent statistics of the Prudential Life Insurance Company call attention to a review by the London *Spectator*, showing something like 1300 homicides occur in this country every year as compared to from 80 to 90 in England and Wales, and that of twenty cities in the United States, Memphis leads the list with 110.

Dr. John T. Moore, Houston, Texas.—This discussion ought not to close without calling attention to our knowledge of physiology in connection with this subject. Reference has been made to putting blood back into the rectum. I doubt blood does any good in the rectum from a physiological standpoint. When we have intestinal hemorrhages it is the disposition of the intestine to get rid of the blood in the quickest possible way. I doubt very much if blood would be absorbed

from the colon. Even were it to break up into serum and corpuscles I doubt if the serum is absorbed at all. It is a waste of time to rely on the absorption of the blood by the colon.

Dr. E. P. Hogan, Birmingham, Ala.—The papers presented by Dr. Burch and Dr. Mason are extremely valuable, in that they reach definite and identical conclusions with reference to the knowledge we possess at the present time on this subject. They have brought before us a subject that is of extreme value.

The laity knows the importance of controlling hemorrhage. The master surgeon knows the importance of controlling a small hemorrhage and of preventing hemorrhage by clamping vessels before cutting, thereby preventing the loss of blood and saving the life of his patient. At any rate, he saves the fighting power of his patient.

I remember years ago the first time I saw Dr. Halsted operate I was impressed with the great care he exercised in controlling hemorrhage. It was a valuable lesson to me. We ought not to lose blood if we can avoid it. If blood is lost and can be restored, it is a great and interesting problem.

There can be no question as to the extreme value of transfusion as it has been worked out by numerous men. The application, as brought out by Dr. Mason, is of great value. I have seen a number of these cases and I know the great value of transfusion, and as our attention is being directed more and more to this subject, I believe in the years to come we will materially improve the technic.

As to autotransfusion in ectopic gestation cases, I want to refer to a case we have had recently of a patient who came in with a greatly distended abdomen. Under anesthesia, I made a mid-incision and blood escaped in great quantity. It was an interstitial ectopic case. I could not control the hemorrhage. The woman collapsed and died within a short time in spite of everything we could do.

In another case where the woman was brought into the hospital hurriedly, I operated under local anesthesia. Through a small suprapubic, mid-line incision I clamped the ruptured tube on either side of the rupture, then ligated, removing the clamps and closed up without drainage. The patient was saved. The intern asked what I had done, and I told him I did not do anything except ligate the bleeding vessels. I left the blood in. I believe in saving that blood. Of course, we

do not know how long it takes for the blood to become absorbed, but I believe in utilizing it in every possible way.

Dr. Willard Bartlett, St. Louis, Mo.—I wish to speak of one phase in the discussion of this subject. Human blood having once escaped from bloodvessels will accumulate in a preformed cavity. That looks like a simple matter, but in reality there are several considerations touching on it that force themselves on our attention. Having done a few infusions after citrating the blood in which benefit seemed to follow, I will say I look with favor on the procedure. The physical properties of the blood which make it valuable are not always those which make it really useful as far as the patient is concerned, because in studying the pathological anatomy we find blood-clots in a healthy serous cavity; but blood escaping in a diseased cavity does not clot. What should be done with that blood? When we open the abdomen in the ordinary case of extrauterine pregnancy, which has not been seriously infected, and find blood, do we use clean blood? We find a large amount of clotted blood.

About the blood that is left in the peritoneal cavity after a massive hemorrhage, I warn you most seriously against leaving any blood if you can get it out of the peritoneal cavity. It is well known that blood in the peritoneal cavity leads to a form of paralytic ileus which is frequently fatal. As proof of that statement, I will call your attention to the monograph of Wilms on "Ileus," in which the subject is handled in no uncertain way.

About putting blood in the rectum: Feeding specialists with experience in introducing protein substances into the rectum dislike it. A possible substantiation is found in our experience where patients have bled after operations upon the stomach. We know perfectly well that if we do not wash the blood out, fermentation or putrefaction of the protein substances takes place, which leads to a complication as bad as one can have after a stomach operation. Possibly one cannot use this particular analogy, but it suggests this, that where the bacterial flora is richer in the lower colon, blood is a less desirable means than in the stomach on account of the putrefactive changes which take place in the stomach and the rapid deterioration.

Dr. M. G. Seelig, St. Louis, Mo.—I would like to say just a word or two to emphasize the point that whenever these

discussions on transfusions are brought up, there is one phase of the subject that is nearly always lost sight of, and the one which has been most bothersome in my clinic work. There is no question that transfusion fills a specific need in surgery; but I think one can safely say that transfusion is not a fixed procedure that one may count upon as being broadly indicated and free from harm.

Dr. Burch, in his paper, referred to a foreign author who pointed out the dangers inherent in transfusion. A few months before his death, Dr. Meltzer, of the Rockefeller Institute, made the statement to me verbally that he felt the surgical profession should bear in mind that transfusion is fraught with danger and should be used with definite caution, and then always with a reasonable sense of doubt. In certain cases of ectopic pregnancy, or of gunshot wounds with an exsanguinated patient, I feel when I finish an operative procedure, that the condition of the patient is so precarious that the slightest wrong move may throw him over.

In many instances of emergency surgery, where hemorrhage is the important factor to color the clinical picture, I am in doubt as to whether salt solution would not be a better medium with which to fill bloodvessels than well-matched blood. My doubts rest on the ever-present possibility of a severe reaction which might be enough to turn the tide in the wrong direction. I am speaking only of those patients in whom we have grave doubt of what reserve resistance is left after the injury and hemorrhage. I know that frequently after transfusion a patient has had a chill with a temperature of 105° (the typical reaction), followed by death. In these instances we cannot help but wonder whether the reserve force of the patient might have tided him over if the transfusion reaction had not occurred. The point I wish to make is that, in the language of the street, transfusion is not "all to the good." Its disadvantages are most clearly manifest in those instances of marked physical compromise when a possibly severe reaction may turn the tide against the patient.

Dr. George A. Hendon, Louisville, Ky.—In traumatic intestinal surgery hemorrhage is responsible for two-thirds of the mortality and the other third of the mortality is due to sepsis. Dr. Mason, in his paper, seems to have reduced the question of control of hemorrhage to a concrete form. Prob-

ably it would be helpful to keep in mind the fact that if we can eliminate the danger of hemorrhage we will have eliminated two-thirds of our mortality. That brings very forcibly to my mind a consideration of the element of time and suggests the fact that to conserve time is to conserve blood. And with that idea fully in mind, it will give us a more definite objective to work to, which seems to be prompt recognition and thorough realization of the importance of immediate action, by reducing the time between the receipt of injury and the application of surgical measures.

Dr. Burch (closing the discussion on his part).—From what little experience I have had with autotransfusion and from what I have learned from the literature, I am of the opinion that it will only have a limited field of usefulness, but in the small percentage of cases where it is indicated it will be found to be a life-saving procedure.

I think the suggestion made by Dr. Shands is an excellent one, but I have not had enough experience in that regard to warrant me to speak with authority. Dr. Sherrill, in his discussion, says that autotransfusion should be resorted to with caution and I believe his remarks are well taken.

A week ago I used this procedure in the wife of a colleague. She had a ruptured extrauterine pregnancy. Being the wife of a medical man, naturally a large consultation was present which took considerable time. While this consultation was going on the nurse came out and notified the consultants that the patient was pulseless and was gasping for breath. The patient's blood-pressure at the beginning of the operation was 80. A quick operation was carried out and a quart of blood recovered which was reinjected. At the end of the operation the patient's blood-pressure was 110, pulse strong and color good. An unusual complication, however, came up as a result of the transfusion. That night she passed eight ounces of bloody-looking urine. The microscope failed to show any blood cells. A guaiac test was made which was positive, showing she had a hemoglobinuria. The next morning the urine was normal and continued to remain so throughout her convalescence. One of the German authors has reported a death from hemoglobinuria. There is no doubt that if this method of transfusion is indiscriminately used it will be a dan-

gerous procedure. On the other hand, where it is indicated and properly used, I believe it will be of great value.

Dr. Mason (closing).—Dr. Gilcreest inquired what experience we have had in operating on low blood-pressure cases. Our records show that the low blood-pressure cases are the ones having the largest hemorrhage, and these are attended with an extremely high mortality. Such cases, however, can be operated on if they are transfused, as mentioned by Dr. Burch and as noted in my case of splenectomy. I removed this spleen, under local anesthesia, with a systolic blood-pressure of 80. The problem of securing donors for indigent patients or those without friends is extremely difficult. I see no solution except by the slow process of educating the people generally to the fact that practically any healthy person can give up a pint of blood without any material inconvenience. The newspapers all over the country have done a good deal of publicity work concerning the value of transfusion. It would be of great advantage to us if they would assist us with some publicity concerning the freedom from danger to the donor who is willing to give up a small amount of blood in an emergency.

There is one other possible solution: If it is accepted that transfusion is an absolute surgical necessity in the type of cases under discussion, public hospitals and industrial hospitals which receive such cases might be prevailed upon, in time, to assume the expense of paying for donors as a part of their moral obligation to their patients, if donors cannot be otherwise obtained.

Dr. Hendon remarks about the loss of time being valuable. We must not lose time unnecessarily, because we know that with perforated visceral injuries suppurative peritonitis will follow. These cases should be operated on within the first six or eight hours. If cases reach us very early we can afford to wait a short time, if, by so doing, we can obtain donors for transfusion to boost them up sufficiently for the operative procedure which is necessary for them to undergo. This delay, however, should not carry them over the ten-hour limit.

FACTORS OF SAFETY IN THYROID SURGERY

By Willard Bartlett, M.D.
St. Louis, Mo.

One who studies the results of thyroid surgery, with a view to lessening mortality and shortening morbidity, may quite well be impressed by the fact that certain fundamental considerations, rather than developments in technic, have pointed out the way toward improved results. Reasoning thus, in our clinic all patients are grouped according to the exceedingly simple classification of Plummer and Wilson under four headings:

1. Exophthalmic goiter (hyperplasia).
2. Toxic thyroid syndrome (adenoma).
3. Simple goiter (colloid, adenoma).
4. Malignant thyroids.

Try as we may, we cannot absolutely classify all patients according to the above, or any other rule, since the symptoms do not always conform to those laid down for any one group, but may at times overlap two or more of them. However, one gets furtherest by at least attempting a definite selection of the larger group in which the individual seems to belong. Without going further into this phase of the subject, which has received extensive consideration at the hands of many authors, we will proceed to the clinical side of it and lay stress on three of its aspects which we have found of utmost value. They are:

1. Classification as to operative indications.
2. Multiple stage operation.
3. Coöperation of internist.

Now as to No. 1, the classification of operative indications, these may vary, and no doubt do with different operators. No doubt there are other classifications equally as useful as our own, but one is prone to enthuse over the procedure which has served him best. Hence, I shall briefly state the five classes into which we divide all patients who are considered fit subjects for surgery. They are:

(*a*) Ligation of the superior thyroid vessel group.
(*b*) Unilateral resection on the male subject.
(*c*) Unilateral resection on the female subject.
(*d*) Bilateral resection with the wound left open.
(*e*) Bilateral resection with complete wound closure.

As is well known, the superior thyroid ligations are done upon exophthalmic goiter patients as a part of their preparation for the removal of thyroid tissue. Ligations are not performed in the presence of toxic adenoma because they do no good, and are even thought by that pioneer, Dr. Charles H. Mayo, to be harmful in many instances.

Unilateral resection on the male (*b*) and on the female (*c*) subjects differ only in so far as cosmetic considerations go. In the former we get at half the gland through an oblique incision along the anterior border of the sternomastoid muscle retract it, spread the ribbon muscles longituinally and thus secure a very easy and direct approach to the lobe, and especially to its important upper pole. In the female we make the customary collar skin incision only, then proceed as above outlined for the male subject. A man's collar will cover any sort of skin incision made for the removal of thyroid substance, while a woman must depend upon some sort of chain during the early period of her post-hospital convalescence. Hence, the separate classification of the two sexes.

Class (*d*) has in mind large non-toxic goiters, irrespective of pathological considerations. After both lobes have been in great part removed, the cavities are packed with rubber and left wide open to allow twenty-four hours' shrinkage in the tissues which cover them. During the next twenty-four

hours complete cessation of bleeding takes place, so that when the wounds are closed there is no longer much likelihood of serum or other fluid escaping from the diminished cavity resulting from such treatment.

Class (*e*) refers to rather small non-toxic goiters, the removal of which is invariably followed by complete closure, because if bleeding be perfectly controlled there is no reason for leaving a drain behind. It may be stated in passing that we never use a drain as the term is commonly applied. We either pack the wound wide open or close it completely in every instance. Wound closure with us is an exceedingly simple procedure, since we no longer make extensive skin flaps nor divide ribbon muscles transversely.

As to No. 2, the graduated approach to the complete removal of thyroid tissue, it may be stated that we have subjected one patient at least to as many as seven operative attacks before the ideal had been accomplished. This was done as follows:

(*a*) We ligated the right superior thyroid group.

(*b*) Five days later we ligated the left superior thyroid group.

(*c*) Twelve weeks later we cut flaps and left a pack exposing the right lobe.

(*d*) Two days later the right lobe was removed.

(*e*) Two days later the skin was closed.

(*f*) Seven months later the left lobe was removed.

(*g*) Two days later this skin wound was closed.

Of course, we have frequently ligated both superior thyroids at one sitting and removed both lobes at another, hence it will be seen that the graduated approach with us has meant two, three, four or even more operative stages up to the number of seven, which is admitted to be the practicable limit. It should be stated, however, that in this last instance we seemed at each attempt to go as far as the patient's endurance would permit.

Too much stress cannot be laid upon No. 3, the coöperation

of the internist. With us this matter is carried to the extent of allowing him the last word in deciding not only what patients shall be operated upon, but he goes so far as to select the date of operations. We believe in this way, and in this way alone, that we can successfully do justice to the many considerations which in the past have led to an unwise choice of time for operation.

We believe that an internist who is especially trained for this work will be guided in his choice of a subject for operation by five major fields for study, which in addition to a large number of minor ones are:

(*a*) Myocardium.
(*b*) Kidney function.
(*c*) Metabolic rate (relative).
(*d*) The patient's weight (relative).
(*e*) The patient's self-control.

These five considerations are so well known and so self-evident that most of them need hardly more than passing mention here; still, one may with propriety add that the myocardium seems to us to play the leading role in the selection of a toxic surgical patient. The kidney function is determined by the ordinary methods of urinalysis, coupled with P. S. P. and N. P. N. in the ordinary run of cases. The metabolic rate is not a determining factor, but is merely taken into consideration with all of the clinical elements which go to make up the résumé. The patient's weight is very important. We feel that it is always a good sign when a patient is gaining weight, provided only that this is not due to an accumulation of fluid in the tissues. The patient's self-control is also of vast importance, especially since most of the operations on toxic patients are done without a deep general anesthesia. The post-operative self-control of the patient should ensure the minimum of restlessness, as the resources of a toxic heart are thus only to be conserved. Here the matter of the patient's self-control becomes of vital importance in many instances.

Very little has been written, purposely, about the operative technic, since, as was stated in the beginning, we believe that our improved results have, in recent years, been largely due to rigid observation of the various classifications which have been briefly stated. Still, there are technical considerations of so much value that it would perhaps be unwise to conclude without at least according them whatever prominence they may seem to deserve. They are three in number:

1. Anesthesia (three components).
2. Where operate?
3. Open or closed wound.

We are in our clinic strictly inclined toward local anesthesia in our operations upon all types of goiters. This is said without minimizing, in any way, the value of general anesthesia in certain uncontrollable patients. We believe, even when we stress novocain infiltration, that, still, a local anesthesia is made up of three components, of which the infiltration is only one, the other two being some sort of a drug preparation (morphine, heroine, veronal, etc.) and the nitrous oxide-oxygen combination, which Crile has made so justly famous as a mask for infiltration. We do not employ this last as a routine, but never refuse it to a sufferer who asks for it, and certainly do not spare it when we feel that we are safeguarding the patient's well-being.

As to No. 2, where to operate, it seems to us that the operating room offers better light and more conveniences than can be obtained elsewhere in the hospital for those individuals whose nervous systems are not unduly influenced by these unusual surroundings. This class can be greatly enlarged by the free use of preliminary drugs, but we often do a ligation in a patient's bed, and indeed during our hot summer months in St. Louis we very much like to do the thyroidectomy, as well as the ligation, on screened, well-lighted, breezy, open porches. It is for the reason that a toxic patient with a high metabolic rate will remain surpris-

ingly quiet if she gets all of the oxygen she needs, as is rarely the case indoors, especially in a small, crowded room.

No. 3, the open or closed wound, has been discussed in passing, but we will refer to it again in connection with the highly toxic goiter. It seems to us that every toxic patient should have the thyroidectomy wound left open in order that there may be no possibility of the damming back of any of the fluids during the course of the operation. This was proved in our earlier work by the removal of sutures, resulting in the rapid clearing up of a dangerous postoperative thyrotoxic condition, as serum escaped from what had been a closed wound. The operation is, in addition, considerably shortened by leaving the wound open, while the patient is only slightly disturbed twenty-four hours later when rubber packs are slipped out and three or four skin clips applied.

One may add, in closing, that the relative space here accorded technical considerations in comparison with that accorded the reasoning of a more fundamental nature expresses pretty well our opinion of the relative values of these two components, which go together to make for better results in the surgical treatment of thyroid disease.

THE RELATIVE VALUE OF SURGERY AND *X*-RAY IN THE TREATMENT OF HYPERTHYROIDISM

By Edward P. Richardson, M.D.
Boston, Mass.

Diseases of the thyroid gland are of interest to many branches of the medical profession. Aside from their great importance in clinical medicine, much remains to be learned about them from a physiological and pathological point of view. Not only is the thyroid frequently the seat of local changes, but through variation in its activity it exerts a profound effect on the organism as a whole. We may, therefore, logically classify cases of thyroid disease on two different bases, that of function and that of pathological changes in the gland itself. On the first basis we may group them according to the activity of the thyroid, which may be excessive, normal or reduced, and on the second, according to various histological changes, of which the chief are hypertropy and hyperplasia, the deposition of colloid, the presence of adenomata, of malignancy or of inflammation. Combining these two aspects of thyroid disease into one comprehensive system, which will satisfy both clinical and pathological demands, is not simple. For the present we are interested solely in those cases of thyroid disease which show evidence of an associated constitutional disturbance, apparently due to a toxemia. While as yet there is no conclusive scientific proof of the cause of these symptoms, they are best explained in the main by an increased output of the active principle of the thyroid gland, thyroxin,[1] which apparently acts to

stimulate oxidative processes throughout the body. This hypothesis, which associates evidence of toxemia with an increased activity of the thyroid, is accepted for the purposes of this paper as being the best in accord with clinical observation.

Clinically the determination of the basal metabolic rate gives us the relation of these increased oxidative changes to a normal standard. The degree of elevation of the basal metabolism enables us to approximate the extent of the thyroid activity. Increased basal metabolism is not only an essential concomitant to the diagnosis of increased thyroid function, but it is also the most accurate single measure by which to judge the progress of the disease and note the effect of treatment. It is not in itself a measure of the degree of operative risk in a given case, but it is an important factor to be taken into consideration with the clinical aspects.

Persistent increase of thyroid activity occurs, with rare exceptions, in conjunction with two types of changes in the thyroid gland, one a diffuse hypertrophy (hyperplasia) and the other an adenomatous change.[2] Associated with these two pathological changes are two clinical types of disease: The first type is exophthalmic goiter and the second adenomatous goiter with hyperthyroidism. For the clear recognition of the second type we are indebted to Plummer.[3] It differs clinically from exophthalmic goiter in developing, at a somewhat greater average age in patients who have had a preexisting goiter for many years, in the absence of eye signs and in the somewhat less intense nervous symptoms. It occurs in from 17 per cent to 20 per cent of the cases of adenomatous goiter resected at the Mayo Clinic.[2] For the constitutional disturbance associated with these two types of thyroid disease, hyperthyroidism is used as a convenient term, although it implies an assumption in regard to etiology not completely proved.

The present stage of the treatment of hyperthyroidism the most effective measures aim at a partial destruction of

the thyroid gland. Of these measures the ones which now appear to yield the best results are surgery and radiation. Neither is a new form of treatment. Reports of the therapeutical use of the roentgen-ray in exophthalmic goiter have appeared in the literature since 1905. In the Massachusetts General Hospital a series of cases of hyperthyroidism treated by roentgen ray was begun by Holmes in 1914. These results of the treatment were reported by Holmes and Merrill[4] in 1919. From the same clinic, Means and Aub,[5 6] using the basal metabolism as an index of intoxication in exophthalmic goiter, compared the effect of treatment by roentgen ray and by surgery.

Previous to the latter part of 1919, cases of hyperthyroidism coming to the Massachusetts General Hospital were treated, some by surgery and some by roentgen-ray, without close coöperation between the two departments, and in occasional instances without detailed study by the medical, services. For this reason, it seemed wise to coördinate the efforts of the hospital. To this end, in October, 1919, a committee, composed of two representatives from the medical one from the roentgen-ray and three from the surgical services, was formed which would have charge of the study and in most instances of the treatment of cases of thyroid disease. The present paper is based on cases studied and treated by the thyroid committee.* The conclusions drawn from the cases are my personal conclusions and not those of the committee. Thanks are due to the committee for permission to use their cases, and particularly to Dr. C. A. Porter for much of the surgical material.

The results obtained in hyperthyroidism by radiation with the roentgen-ray were felt by the committee to be sufficiently encouraging to justify a continuation of this form of treatment in selected cases. At the same time the committee believes that roentgen-ray treatment should be limited, as

* Dr. C. A. Porter, Dr. G. W. Holmes, Dr. J. H. Means, Dr. M. Seymour, Dr. A. W. Allen.

stated by Holmes and Merrill,[4] to cases which show symptoms apparently due to increased function of the gland, such as increased metabolic rate, rapid heart action, nervousness, loss of weight, weakness, etc. Goiters with normal or reduced function, requiring treatment for deformity, pressure on adjacent structures, potential malignancy or potential hyperthyroidism, should be treated by surgery and not by roentgen-ray. The only exception to this is in malignant goiter beyond reasonable hope of benefit from operation. Here roentgen-ray has an important role. Beyond this, roentgen-ray is not a treatment for goiter; it is a treatment for hyperthyroidism.

On what evidence should a diagnosis of hyperthyroidism be based? Persistent increase in the basal metabolic rate is considered necessary to confirm the usual clinical evidence in the diagnosis of hyperthyroidism. On the other hand, a basal metabolism, consistently within normal limits, should exclude hyperthyroidism. The only conditions which would justify roentgen-ray treatment at all are obvious hyperthyroidism confirmed by increase in basal metabolism or persistent and clearly marked increase of basal metabolism in a patient suggesting thyroid disease, who showed, on careful study, no other cause for increased metabolic rate.

Beyond accurate diagnosis there are certain other essential conditions without which roentgen-ray should not be undertaken. The first is adequate modern roentgen-ray equipment, with ability to measure dosage. The second is means of estimating the degree of benefit obtained by determination of the basal metabolism as well as by clinical observation. Without this a slight degree of persistent hyperthyroidism demanding further treatment may be overlooked or treatment may be continued when there is danger of myxedema. The third is careful and accurate clinical supervision. An open mind should be kept in regard to switching to surgical treatment if improvement is not rapid and complete.

If these conditions are fulfilled, as I believe they have

been in cases treated through the Massachusetts General Hospital Thyroid Clinic, what are the probabilities of "cure" by roentgen-ray in selected cases? This necessitates a definition of "cure." When, as suggested by Dr. C. A. Porter, the basal metabolism is reduced permanently to within normal limits, we have done all that is possible by surgery, or possibly by roentgen-ray, to produce a "cure." This does not necessarily mean that an roentgen-ray "cure" is as good as a surgical "cure." In either case permanent organic damage may have occurred which is beyond benefit, or symptoms from the underlying unknown cause of exophthalmic goiter, or from changes in the quality of the thyroid secretion may persist. It is hopeless to expect that surgery or roentgen-ray will relieve permanent organic damage caused by the disease. These patients, as a group, are likely to represent inferior risks during life. Permanent reduction of the metabolism to within normal limits is ordinarily accompanied by marked improvement, subjective and objective, and in this sense "cure" is used.

A paper by Means and Holmes[7] on the results of roentgen-ray treatment in hyperthyroidism gives the following facts: Of a recent series of 58 cases of hyperthyroidism treated by roentgen-ray, 44 cases were exophthalmic goiter and 14 were classed as toxic adenoma. Of the 44 exophthalmic cases, 13 were apparently cured, and 15 were improved but not rendered entirely free from hyperthyroidism. Sixteen showed little or no improvement; 8 of these latter came to operation and were permanently cured. There were no cases that seemed to be made worse by the treatment. Two of the cases that improved were later operated on, and of these 1 died. This was the only death known.

Of 14 cases of toxic adenoma, all improved and 5 were cured. A composite chart of metabolism, pulse and weight curves in 28 cases of exophthalmic goiter that improved under roentgen-ray treatment showed a maximum benefit during the first four months of treatment. This figure is

reproduced by permission of the authors. No further significant drop in pulse or metabolic curves occurred in the next six months, in spite of more treatments. In the second year there was a slight drop. They conclude that the roentgen light probably has a beneficial effect in toxic goiters, that about two-thirds of the patients with exophthalmic goiters show either recovery or improvement coincident with the treatment; that in exophthalmic goiter, if good results are not secured with roentgen-ray in a few months, surgery should be employed. (Fig. 1.)

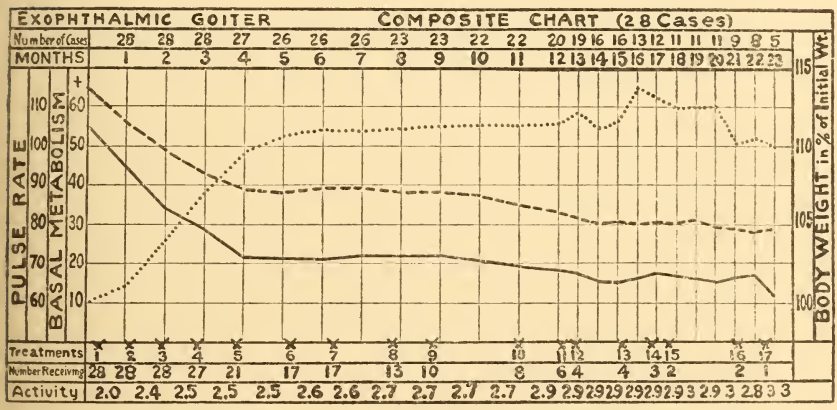

Fig. 1.—From Means and Holmes.[7] In this and in the following figures the solid black line denotes metabolism, the interrupted line pulse and the dotted line weight. The roentgen-ray treatments are shown thus: *X*, the number below indicates the number of that particular treatment. Under activity we have indicated the magnitude of the rest factor. We arbitrarily have selected three grades of activity: 1 = complete rest in bed; 2 = not in bed, but doing no work; 3 = working or following usual mode of life. In the composite averages of the individual activity, figures are shows for each month.

In comparison of the above series of cases treated by roentgen-ray, I have charted the metabolism, pulse and weight in 30 consecutive cases in which surgical treatment has been completed. The numerous metabolism determinations have been made under the direction of Dr. J. H. Means,

to whom I am indebted for permission to use them. Complete surgical treatment is considered to consist of subtotal thyroidectomy or the removal of the whole gland except an amount which is in the surgeon's judgment necessary to maintain normal thyroid function, usually consisting of the inner posterior portion of both lobes. Except in mild cases, this result is obtained by a series of graded operations. While ligation of the thyroid arteries or hemithyroidectomy are occasionally curative, these operations ordinarily represent only a stage which the patient passes through on the way to a subtotal thyroidectomy, and it is manifestly unfair to judge surgery by the results from these partial operations.

Of the 30 cases of subtotal thyroidectomy, 25 (85 per cent) showed a drop in metabolism to +15 or less when last observed. Four cases, with an average metabolism of 69 per cent, still showed evidence of hyperthyroidism, although clinically greatly improved, presumably because the surgeon failed to estimate correctly the amount of gland which should be removed to restore metabolism to within normal limits. One mild case has shown an hypertrophy of part of the remaining thyroid tissue, with return of symptoms, and is now convalescing from removal of more of the gland. (Fig. 2.)

An examination of Figs 1 and 2 will show that both charts are constructed on a similar plan. While they both start out with the maximum number of cases, only relatively few cases are followed throughout the whole period. The number of cases figuring at any time is shown by the figure above each ordinate. The starting-point taken in the surgical cases has been the last metabolism determination before operation. The curves obtained are in no sense end-result curves; they approximate, however, the results obtained in each class of cases as a group.

A comparison of the composite chart of the cases treated by roentgen-ray and those treated by thyroidectomy show the following facts: The average result of all cases treated

by subtotal thyroidectomy are better than the results in a selected two-thirds of the cases treated by roentgen-ray. The metabolism shows a drop to about +10 as compared with +20 for the roentgen-ray cases, the pulse a drop to 80 as compared with 90; the weight shows a tendency to more persistent and greater increase. The rate of fall in metabolism and pulse is about equal in the two charts. The reason for this is that in certain of the patients who underwent ligation of both superior thyroid arteries, followed by thyroidectomy in two stages, the whole of the surgical treat-

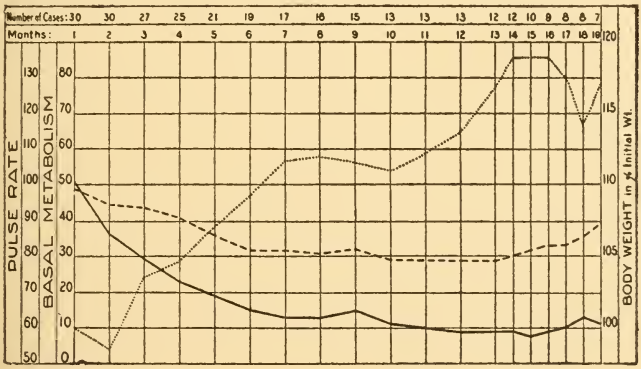

FIG. 2.—The curves begin at the time of the first operative procedure, the averages used as a starting-point are those obtained at the last metabolism determination before operation. This preceded the operation by a variable period which is not shown. The time in months should begin with zero and not with 1.

ment required four months, and in one case eight months for completion. For comparison, a composite chart of 9 cases treated by immediate subtotal thyroidectomy in one stage is added. Here the sharp fall in metabolism and pulse and gain in weight are striking. There can be no doubt that the average results in surgery are better than those following roentgen-ray treatment. (Fig. 3.)

In discussing these results there are three questions of

principal importance: (1) Is the improvement noted following roentgen-ray due to fluctuation in the disease or due to the treatment? (2) If roentgen-ray is used, what class of cases should it be used in? (3) If the results of surgery are better in general than those of roentgen-ray, why should roentgen-ray be used at all?

After seeing the cases treated by roentgen-ray, I have no hesitation in saying that I agree with Means and Holmes,

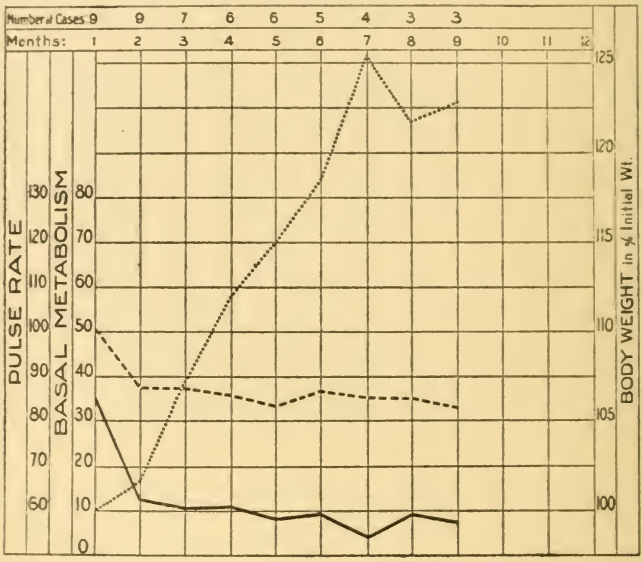

FIG. 3.—As in Fig. 2.

and believe the improvement in the majority of instance-at least due to the roentgen-ray. In my opinion the improvement coincident with the use of the roentgen-ray is too sudden and striking to be accidental. In a few instances this is emphasized by a preliminary period of observation during which no change in the course of the disease occurred. In some cases the results of treatment are as brilliant as any I have seen by any therapeutical method. Nor is the improve-

ment due to a long period of rest, as in the series of cases reported by Kessel, Lieb and Hyman.[8] While it has been thought desirable to carry out, when possible, a study of these cases in the hospital before instituting treatment, in the majority of cases there has been no marked change in the way of life. The average activity, as shown by Means and Holmes on Chart I, has been between 2 and 3 on an arbitrary scale, from 1 to 3, in which 1 represents rest in bed, 2 partial rest (in which the patient is up and about, but has rest periods and does not work), and 3, ordinary mode of life. If the roentgen-ray were inert we should expect cases to get worse as well as better. As a matter of fact, this has not occurred.

If the roentgen-ray is effective in certain cases of goiter, is it possible to detect those cases in which it is likely to show good results? It has not proved possible to predict the effect of roentgen-ray in any given case. Means and Holmes[7] are unable to show that either the age of the patient or the intensity of the hyperthyroidism, as shown by the level of the metabolism, is a factor determining the success or lack of success of roentgen-ray treatment. An impression that recent cases in young people were more responsive to the treatment was not borne out by their statistical study. There are, however, certain cases in which roentgen-ray seems to me unsuitable. Among these are adenoma with hyperthyroidism. Here the cause of the symptoms seems to be within the thyroid gland, and it is not only logical to remove this cause surgically, but the late results of operation are better than in exophthalmic goiter. Judd[9] reports 83 per cent of cases of adenoma with hyperthyroidism cured by surgery as compared with 65.8 per cent of patients with exophthalmic goiter. Another group of cases consists of those showing organic damage, particularly cardiac. In these cases I believe the time consumed by roentgen-ray treatment may lead to further damage. These patients need certain relief from their toxemia. This can only be assured

by surgery. A course of roentgen-ray treatment may leave us four or five months along and no better off. If roentgen-ray is used in these cases, it should be as an adjuvant to the effect of preliminary ligation of the thyroid arteries.

The economic situation may have a bearing on the choice of roentgen-ray or surgery. For instance, a wage-earner may well desire the most rapid and certain means of cure. On the other hand, for a mother with several young children, it may be advisable to try the safer course of a series of roentgen-ray treatments. In general, it can be said that the roentgen-ray should not be used in any case in which a few months without relief is likely to be productive of definite damage, nor in adenomatous goiter with hyperthyroidism, except in unusual instances. If it is used, a definite time-limit should be fixed which I think could well be set for four months, during which the patient usually receives five treatments. If a satisfactory response to roentgen-ray has not been secured by this time, operation should be undertaken.

If surgery is more effective in the average case, why should roentgen-ray be used at all? Surgery is a clumsy form of treatment for a gland which is hyperactive. In exophthalmic goiter the ultimate cause of the disease is unknown. By removing part of the gland we are not affecting the cause; we are merely removing part of a gland which is excited to hyperfunction. The changes accompanying hyperfunction are still present in the part of the gland which remains. The amount of the gland left to maintain thyroid function is purely a guess on the part of the operator. When surgery can accomplish safely removal of a proper proportion of the gland, it has reached its limit. The roentgen-ray, on the other hand, while also acting as a destructive physical agent, has, nevertheless, the possibility of indefinite expansion as a means of treatment. Improvements in technic and manner of application may lead to results as yet unobtained. It shows sufficient promise to be given opportunity.

Certain minor advantages have been claimed for roentgen-

ray treatment. These are absence of operative scar, sparing the patient the distress and discomfort of going through operative procedures, and the fact that hospitalization may not be necessary. Although these advantages loom large in the minds of patients, hyperthyroidism is a sufficiently serious condition in its immediate and remote effects to make these advantages deserving of slight consideration in advising treatment.

The chief advantage of roentgen-ray is that its immediate mortality is *nil*. The use of the roentgen-ray in our clinic is undoubtedly influenced by the fact that the mortality in the cases of hyperthyroidism treated surgically since the organization of the thyroid committee is 7.1 per cent. There have been 5 deaths among 70 cases, in some of whom the surgical program is as yet incomplete. The surgical aspects will be presented later in detail. While the mortality from surgery reported from certain large clinics is small, this would probably not be true of small series and isolated cases collected throughout the country. The stage of gaining experience in this condition is likely always to result in mortality. It must be remembered that mortality is often figured from the number of operations, not from the number of patients treated, and that figures may combine toxic and nontoxic cases. It has been said that recommending roentgen-ray has done harm. It is also true that unqualifiedly recommending operation on the diagnosis of exophthalmic goiter may do harm.

Roentgen-ray will accomplish "cure" of a certain percentage of cases. In others it will bring about a degree of improvement which will permit of safer operation or make unnecessary some of the preliminary operative steps. It is another weapon in the treatment of hyperthyroidism. The question is how and when to use it.

Many objections have been raised to roentgen-ray treatment. The chief of these is the temporary relief afforded. While it is true that in certain cases there is a tendency for

the metabolism to rise after a period within normal limits, these are a small minority. In these, as a rule, roentgen-ray treatment results in a second drop to a normal metabolic level. On the whole, the results in cases brought to within normal metabolic limits seem to me satisfactory.

A second objection is the occurrence of myxedema. Means and Holmes[7] report that since the beginning of the roentgen-ray treatment at the Massachusetts General Hospital, 4 cases have developed myxedema. Two developed it within the first four months of roentgen-ray treatment. In both the depression of metabolism proved temporary. One case developed myxedema eighteen months after roentgen-ray treatment; another, five years after. Whether in these cases there is any actual connection between the treatment and the myxedema is uncertain. It seems to me that the danger of myxedema following controlled roentgen-ray treatment is more than balanced by the possibility of recurrent laryngeal nerve injury, particularly bilateral abductor paralysis, or parathyroid injury, following surgery.

Another objection is the increased difficulty of operation following roentgen-ray. The cases coming to operation in this clinic after roentgen-ray have been treated here. They have been, as a rule, exophthalmic cases; if toxic adenomata, the goiter has been small. In these cases there has been no appreciable increase in difficulty of operation. The gland has not been adherent to the anterior muscles. The only change I have noted has been a somewhat firm consistency to the gland, and possibly a slight increase in fixation posteriorly. The increased operative difficulty has been no more than that after preliminary ligation.

A fourth objection is the time required for roentgen-ray treatment. If the cases are carefully selected and the treatment is strictly limited to four months, this is not of great importance compared with the possible benefit. It is not longer than the period which may be required for a graded series of preliminary operations.

My personal objections to roentgen-ray treatment are somewhat different. In the first place I cannot help fearing remote ill effects from so powerful and so little understood a physical agent. It can only be said that these as yet have not developed. Further, the suggestion of an alternative form of treatment, surgery or roentgen-ray, lessens the authority of the clinic. It is difficult, under these conditions, at times to carry out surgical procedures when they become advisable.

I have no quarrel with the cases apparently cured by roentgen-ray. These results seem to me sufficiently good. Nor am I troubled by the cases in which roentgen-ray frankly fails. These cases have lost time and have been put to trouble and expense, but they are willing to undergo operation, and the ultimate results are likely to be good. The cases improved but not cured seem to me a serious objection. They are sufficiently benefited to feel reasonably well and carry on their normal life and work with fair comfort. Still, they are distinctly and recognizably thyrotoxic. Basal metabolism may show a persistent elevation of fifteen to twenty-five points. Not infrequently they may present bizarre forms of hyperthyroid abnormality. In some cases the picture may be so close to normal that it is difficult to say whether operation is advisable or not. In other cases thyroidectomy may be clearly indicated. But these cases are likely to refuse surgery. Here is the real objection. The patients recognize their great improvement, and since they are able to live and work in relative comfort, they do not wish to undergo operation. The ultimate fate of these patients is as yet uncertain. My feeling is that they go on receiving organic damage, and that their life and usefulness are shorter than it would be from the more complete cure possible by surgery.

A fourth class of cases, of no significance in determining the value of roentgen-ray treatment, is, nevertheless, of practical importance. These are the cases that start roentgen-ray treatment, and for one reason or another abandon it.

It is true that many of these cases receive adequate surgical treatment elsewhere. Some undoubtedly do not, and in them the disease may progress without any adequate measures of relief. The fate of these patients is beyond the control of the clinic; a responsibility is assumed in regard to them which through their own fault cannot be fulfilled. It is possible that surgery might have been refused. At the same time a definite surgical program, once started on, is less likely to be abandoned.

It should be appreciated that there is no less responsibility in advising roentgen-ray treatment than in advising operation. The ill-effects of roentgen-ray are more remote and require more imagination to grasp. It should not be advised as a way of postponing a difficult decision on account of its lack of immediate danger. The man in charge of roentgen-ray treatment, like any other therapeutist, is likely to see little but good from his efforts. Some results are brilliant. Many other patients are much improved. The failures are likely to be operated on or to drift away; in either case they disappear from the clinic. The harm that needs to be visualized comes, I believe, to these improved patients, through damaging effects of a slight persistent hyperthyroidism. The stage of improvement without "cure" I believe to be the serious phase of roentgen-ray treatment; it should constantly be borne in mind.

If roentgen-ray treatment is advised at all it should be with the clear understanding that it will be tried for only a few months; that relief is uncertain; that if improvement is not sufficient at the end of that time, operation must be undertaken.

The patient should know that operation will eventually be advisable more often than not.

Conclusions. 1. Subtotal thyroidectomy is a more effective form of treatment of exophthalmic goiter than roentgen-ray treatment.

2. Roentgen-ray has a beneficial effect in certain cases of hyperthyroidism.

3. This effect is not sufficiently constant to be relied upon as the sole form of treatment. In selected cases of exophthalmic goiter the use of roentgen-ray treatment, under careful control, is justifiable for a period of four months, during which the patient receives about five treatments.

4. If after four months of treatment the degree of improvement obtained in general condition and basal metabolic rate does not promise "cure," operation should be undertaken.

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DISCUSSION ON THE PAPERS OF DRS. BARTLETT AND RICHARDSON

DR. JOHN R. WATHEN, Louisville, Ky.—Goiter is a live subject and has been for the last twenty years. We have all listened to many theories, and our views have changed considerably. My own experience with goiter comprises over 1000 operated cases, and I hesitate to present my views to an association of this kind composed as it is of men who have done so much goiter work.

A point that has impressed me in goiter work today is that in our exophthalmic goiters we should do more pole ligations, not only as preliminary operations but as final operations. In going over my statistics I have noticed in those cases where we have been in no hurry to do secondary operations, but waited

six months or a year, or a year and a half, we had permanent cures following double pole ligation the same as from more radical operation. We have been in too much of a hurry to do a secondary operation following a preliminary pole ligation. Pole ligation is a radical procedure in the sense that it cures the patient in a large percentage of cases by reducing the metabolic rate; the tumor disappears more or less and the patients often do as well as they do from more radical operations. Therefore, I would make a plea for more pole ligations and a longer time between the pole ligations and radical operation.

In regard to the roentgen-ray treatment, I consider it very pernicious. I have seen only temporary benefit from it. It has been my misfortune to have operated on a large number of cases after prolonged roentgen-ray treatment, and in every single instance where the roentgen-ray treatment was prolonged there were adhesions of the capsule and the vascularity was greatly increased, and the patient was a bad risk surgically. The roentgen ray has its place, but not in thyroid surgery.

Dr. Charles H. Mayo, Rochester, Minn.—For thirty years I have been discussing the question of thyroid surgery. In the early days the death-rate was 10 to 20 per cent. There was no preparation of patients in those days. In a few clinics in this country the mortality rate has now been reduced to a fraction of 1 per cent following operation.

In all these years no medical treatment has been developed in handling goiter cases which would in any way approach the results obtained by surgical treatment, especially cases of exophthalmic goiter. When one studies the problem and formulates a method of treatment, as Dr. Bartlett has done, no matter what that method may be, the surgeon will get some satisfaction and the patient will get some benefit from the operation.

I agree in the main with what has been said with regard to ligation. A single ligation can be done safely, and it tests the condition of the patient for the operation at the end of a week or more. If the patient does not stand a single ligation well, the surgeon will delay operation according to the degree of reaction. Either he will operate in a few days afterward or he will let the patient go home and return for subsequent resection. There may be quite an interval between the first and second operations.

Ether anesthesia has been repeatedly discussed in connection with these operations, and I do not believe there is anything to be added to what has been said concerning its benefits.

I was greatly interested in the charts presented by Dr. Richardson. There is a wide difference in the immunity developed by patients suffering from exophthalmic goiter. Personally, I believe we will find a chemical reaction to be the cause. The thyroid gland is stimulated to secrete. The body demand is the stimulus for thyroid secretion, hence there will be types of germs, possibly in the intestine, which stimulate hyperplasia, because there is something more in the question of exophthalmic goiter than just hyperplasia and increased secretion. When once the break comes there arises the question of chronic disease with its waves of exacerbations and remissions. Such remissions are not based on any reliable records, but patients get better, the metabolic rate improves and their weight increases.

We rarely see a patient in the early stage of the disease who has not been treated medically, although medicine has yet failed to cure these cases. More of these patients would die today of the disease if let alone than would die from surgical treatment.

It is important to know how long these patients have been sick and how many exacerbations and remissions they have had. I have operated on patients who have come to me with extensive roentgen-ray burns over the neck. One patient had an epithelioma due to treatment by roentgen ray, and it was necessary to remove a large scar. Patients often come to us scarred from having had roentgen-ray treatment for exophthalmic goiter, although some of them did not have exophthalmic goiter. They had been urged to take roentgen-ray treatment because they were nervous. I believe with Dr. Bartlett, if we can work out a good technic and use good judgment, surgery is the best possible treatment for this class of patients. If, however, they are to be subjected to three or four months' roentgen-ray treatment, and then require surgery, I would rather be away from home when they come.

If surgical methods in any community are not as safe and as permanent as medical, then I would advise the surgeons to turn their cases over to any method which is permanent and safer than theirs.

Dr. Richardson (closing).—It is possible that up to the present the situation in regard to the treatment of exophthalmic goiter might be better if roentgen ray had never been suggested as a therapeutic method. It is also possible, although I think hardly probable, that the benefit occurring after roentgen-ray treatment is due to fluctuation in the natural course of the disease. But I believe it would be very hard to convince those who follow cases treated by roentgen ray that the improvement in the majority of cases is not due to the treatment. We must assume that enough has been said in the literature in regard to roentgen-ray treatment, so that a certain proportion of cases of exophthalmic goiter are going to be treated by this method. Under these conditions the important thing is to point out the limitations of this form of treatment and the control under which it should be used. This I have attempted to do in the present paper.

In regard to the increased difficulties of operation after the use of roentgen ray, the few cases we have operated on have been treated by roentgen ray in our own clinic. Under these conditions we have not found any definite increase in operative difficulty.

NON-UNION OF FRACTURES AND THE TREATMENT

By Dean Lewis, M.D.
Chicago, Ill.

There are certain obvious causes of the non-union of fractures. Bone, even when proliferating abundantly, does not regenerate in sufficient amounts to bridge a gap, providing all the osteogenetic elements previously occupying such have been lost. Therefore, when loss of substance occurs in one of two parallel bones, the other remaining intact, the ends of the fragments of the fractured bone cannot come in contact and non-union occurs. Non-union due to the cause just mentioned naturally occurs most frequently in the bones of the forearm and leg.

Longitudinal displacement may also be the cause of non-union. This is operative most frequently in the humerus, the lower fragment being separated from the upper by its own weight. Separation of fragments with consequent non-union is also occasionally due to a poorly applied Lane plate, the fragments being separated when the plate is applied and fixed. An example of this will be cited in the case histories.

Marked lateral displacement may be followed by non-union. Non-union occurs in those cases in which the periosteum has been so much stripped from the fragments or torn that it no longer connects the fragments. In such cases sclerosis of the ends of the fragments may occur. This may prove an obstacle to repair when operations are

undertaken to correct the non-union. Eburnation of the ends of the fragments only becomes operative as a cause of non-union when the fragments have been separated for some time.

It is difficult to determine the relation of infection and lack of sufficient immobilization to non-union. Infection more frequently delays than prevents union. Solid union frequently occurs in the presence of a discharging sinus. Infection may cause non-union by destruction of the periosteum, which plays an important role in the repair of a fracture or by interfering with its blood supply by separating it from the soft tissues whence it receives its blood supply.

Insufficient immobilization seems in some cases to favor repair, in others to delay or prevent it. In individual fractures it is difficult to determine what the effect of insufficient immobilization may be. The experimental work of Cornil and Coudray has shown that healing of a fracture occurred in spite of the fact that the fragments were displaced daily by each other with considerable force. After eighteen days in these experiments there was no motion. The callus in such cases was larger than in those in which the fragments were properly immobilized and consolidation was but little delayed. That insufficient immobilization may be a cause of non-union is, however, a common experience. Lexer states that the different effects of insufficient immobilization depend upon the way and rapidity with which the periosteal vascular supply develops and the character of the tissue developing between the fragments.

Interposition of soft tissues between the fragments is, I believe, a much rarer cause of non-union than generally supposed.

There are certain fractures in which non-union occurs even when the fragments are perfectly approximated and all the principles governing the treatment of fractures have been strictly adhered to. Non-union in such cases is observed

most frequently in the humerus near the junction of the middle and lower thirds; in the lower third of the tibia; and in the thin part of the neck of the femur. The line of fracture is usually transverse or somewhat oblique. It is difficult to determine the cause of non-union in these cases, due to the failure of the tissue which forms between the fragments to become converted into bone. It may be due to insufficient blood supply, either to interference with the nutrient artery or to failure of development of the periosteal vessels which appear early after fractures associated with much stripping of the periosteum. The periosteal vascular network which develops so abundantly after fractures plays the leading role in the formation of callus and repair and the failure of the tissue which forms between the ends of the fragments to go on to complete repair may be due to interference with or the failure of development of this vascular network.

In spite of the amount of work that has been done upon the repair of fractures, there is considerable difference of opinion concerning the role played by the different elements. Ely, as a result of his experimental work, comes to the following conclusions: (1) When periosteum is intact, bony union is to be expected; (2) when periosteum is completely divided, bony union is not to be expected; (3) when periosteum is slit, bony union may or may not take place. He makes the following statement concerning the formation of callus: After an ordinary fracture, hemorrhage occurs from the marrow cavity under the periosteum. The periosteum is stripped up from the cortex by this hemorrhage and by the fracture. Then fibrin is deposited and granulation tissue, later to be converted into cartilage and bone, forms between the periosteum and cortex. Probably the function of the periosteum is only important in the early stages of the formation of the cartilaginous callus. The periosteum probably serves to keep the hemorrhage from escaping and the granulation tissue

undisturbed. It has, according to Ely, no bone-forming function, and bone is not formed out of it. The subsequent ossification of cartilaginous callus is carried out almost entirely, if not exclusively, from the external aspect of the cortex. The internal callus plays no effective part in the union. It is rudimentary when present.

Although there may be considerable difference of opinion concerning the role of the periosteum in repair of fractures, largely due to the definition attached to this membrane, there can be no difference of opinion concerning the importance of the external callus in repair. This callus is largely dependent upon the periosteal vessels for nutrition. These vessels, especially when the periosteum is stripped somewhat, proliferate rapidly to form a heavy vascular network, and the role played by these vessels in regeneration and union has not received sufficient attention. As previously stated, interference with or failure of development of this network may account for some cases of non-union. Its importance has recently been emphasized by Lexer.

CONGENITAL PSEUDARTHROSIS

In 1903, Reichel published an article dealing with the treatment of a severe form of pseudarthrosis following what is referred to in some cases as intrauterine fracture of both bones of the leg. This type of fracture occurs in the lower third of the leg, both bones being involved. The foot is drawn backward by the tendo Achillis, so that a very noticeable deformity develops. This is a sharp angular deformity, the angle at the junction of the fragments being directed forward. The fragments become very atrophic and often end in sharp points. A scar is not infrequently found in the skin over the fracture. It has been suggested that this scar is due to the adhesion of fetal membranes which contributed to the changes in the bone which finally resulted in a pathological fracture.

The following 3 cases may be classified as congenital pseudarthrosis. In one case, however, the fracture, which was pathological, occurred at a later date. Strictly speaking, it was not congenital, but the changes in the bone were very similar to those observed in the cases reported as congenital pseudarthrosis.

In all of these cases a typical deformity associated with marked atrophy of the ends of the fragments developed. The non-union is undoubtedly due to a local cause, probably to the inability of the periosteum at and in the immediate neighborhood of the fracture to form callus. Bone re-forms in the opposite tibia from which a graft is taken. In one of Reichel's cases he split the upper fragment and forced the lower fragment into the fissure. Repair occurred higher up in the bone, which was split, but not at the site of the fracture. In one of the cases which I have observed, the cortical bone was so soft and thin that a graft removed from the tibia became wrinkled and folded upon itself when it was used to bridge the fracture.

Case I.—B. W., a boy, aged seven years, with the following history: Dry labor, delivered by forceps. Mother states that some deformity of the leg was noticed at birth. This became much more marked when the child made the first attempts to stand. A fracture was noted at this time. According to the mother's statement, there has always been some shortening of the leg. The angular deformity has steadily increased.

On October 2, 1909, when the child was seven years old, an attempt was made to correct the non-union. The ends of the fragments were removed and the freshened surfaces approximated and united by catgut. A cast was applied for immobilization.

The patient was re-admitted to the hospital, June 16, 1910. Non-union had recurred and an angular deformity at the site of the fracture was again noted. Another opera-

tion was performed; the ends of the fragments were resected so that they would overlap and were wired in position.

On April 24, 1911, another operation was performed for the non-union. A portion of the fibula was used as a transplant and a Lane plate used for fixation.

On April 14, 1912, still another operation was performed. An incision was made over the fracture and the Lane plate was removed. The ends of the fragments consisted of dense white bone. The lower fragment overlapped the upper. A transplant at this time was taken from the opposite tibia and fixed in place by silver wires.

On June 1, 1913, another bone graft was inserted.

On April 14, 1914, no union having occurred, an amputation was performed below the knee.

Case II.—S. M., aged five years, was admitted to the Presbyterian Hospital, June 22, 1915, and discharged, August 25. The parents noted that the child cried a great deal soon after birth. Apparently it felt considerable pain in the left leg at an early date. When it attempted to walk a limp was noted. An angular deformity then developed in the lower part of the left leg. When the child was one and a half years old, an operation was performed and a plate applied. Infection occurred, and four months later the plate was removed. The deformity later increased. On June 23, another operation was performed. An incision was made over the fracture. The fragments were exposed and the ends resected. The deformity was corrected. A bone transplant was then removed from the anterolateral surface of the right tibia, measuring three inches in length, a half inch in width and a half inch in thickness. The fragments were flattened somewhat and the transplant, after being laid across the defect, fixed with four silver wires. The wound was closed and a plaster-of-Paris cast applied. The wound was clean when the stitches were removed.

The following cases differ from the preceding in the age at which the fracture occurred. The deformity is the same and the changes in the cortex are those associated with a periosteal dysplasia:

Case III.—G. S., aged nine years, was admitted to the Presbyterian Hospital, March 21, 1915. When five years old she stepped off a curbing and broke both bones of the left leg in the lower third about three inches above the ankle. The fracture was reduced and a cast applied. This was removed after two weeks. The patient later was unable to use the leg because of non-union and later an operation was performed to correct it. After resection of the ends of the fragments they were wired. This operation was unsuccessful and later another attempt was made to correct the non-union by plating. This operation was also unsuccessful.

The deformity in this case is quite typical. The apex of the angular deformity is directed forward. The fracture has occurred quite low in the leg.

On March 22, an operation was performed to correct this deformity and secure union. The fracture was exposed and the scar tissue was removed from between the fragments, which were approximated in good alignment. Permission had been asked to use a graft from the opposite leg. This was refused. The cortex of the tibia proximal to the fracture was so thin and soft that the transplant removed from it became wrinkled and folded upon itself, when placed across the fracture. This graft was fixed in position by catgut sutures and the ends of the fragments fixed with the same material. Non-union again occurred and several years later an amputation was performed.

These cases have many things in common. In Case II, the fracture occurred early when the first attempts at walking were made. In Case I, some pain must have been felt in the leg before the attempt at walking was made. In

Case II, the fracture occurred when the child was five years of age. This was apparently a pathological fracture, for no great force was applied. In all, a rather typical deformity, due in great part to the location of the fracture, developed. Marked atrophy of the ends of the fragments without any evidences of bone repair is a striking feature.

Reichel, in 1903, reported a successful operation upon one of these cases. A tenotomy of the tendo Achillis was first performed to permit of correction of the deformity. An ivory peg was then inserted to maintain correction after the ends of the bones had been resected and a pedunculated osteoperiosteal flap from the opposite tibia was fixed over the fracture. Immobilization of both legs was maintained by a cast for twenty days when the pedicle of the flap was cut. An ordinary circular cast was then applied. This operation was performed, June 13, 1902. Union had occurred by January 18, 1903.

Non-union is apparently due in these cases, as stated above, to a local periosteal dysplasia. Evidently in some cases, fairly heavy bone may develop about the ends of the fragments. Many of the procedures, which have been employed in the attempt to secure union, such as plating and inserting wire, should be discarded. Fixation by a massive transplant, combined with the use of a periosteal flap, should afford the best prognosis. Firm fixation is an essential part in the treatment of this form of non-union, and the localized defect in periosteal bone repair must be compensated for by the use of an osteoperiosteal flap.

THE USE OF TRANSPLANTS PREVIOUSLY INSERTED, BUT WHICH HAVE SLIPPED, BECOME BROKEN OR INFECTED IN THE TREATMENT OF NON-UNION

Case IV.—B. J., aged thirty-two years, entered the Presbyterian Hospital, November 8, 1915. During September, 1906, the patient's left arm was caught between

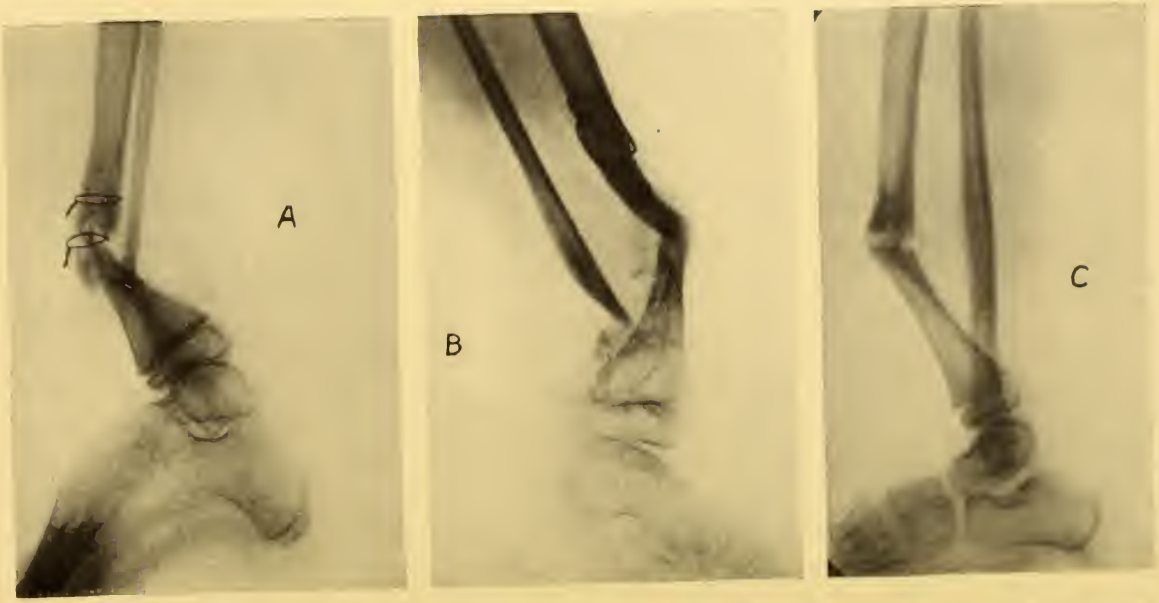
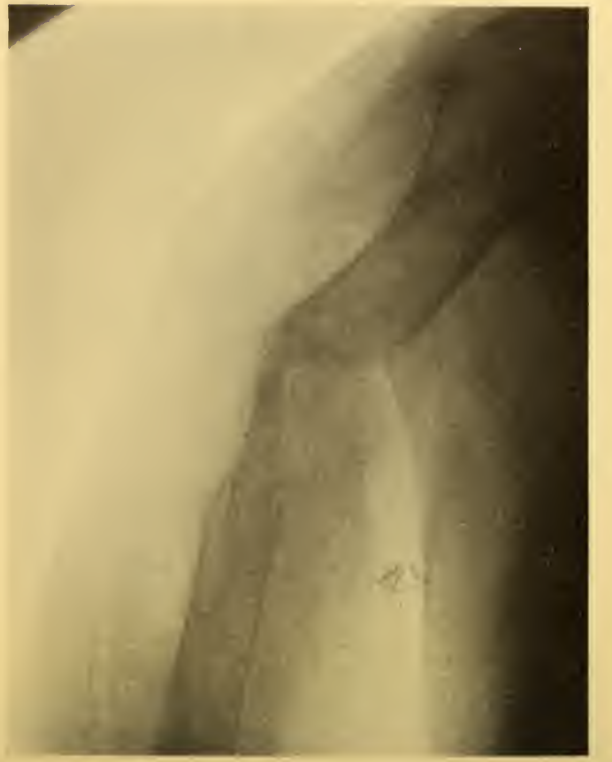


Fig. 1.—Congenital pseudarthrosis. Typical deformity with marked atrophy of the ends of the fragments. Deformity due to action of muscles on the posterior surface of the leg. Histories given under Cases I, II and III.

Fig. 2.—Non-union of nine years' duration. Nearthrosis. Transplant slipped at first operation. At second operation the transplant was found to be firmly united with the lower fragment. The transplant was vivified and forced into medullary cavity of upper fragment. Fixation with small Lane plate. Rapid union. Firm fixation probably important factor in union. Fragment of bone from upper extremity of bone transplant shows bone cells. This portion of transplant not contacted with bone and the bone cells are undoubtedly derived from the transplant itself. History given under Case IV.



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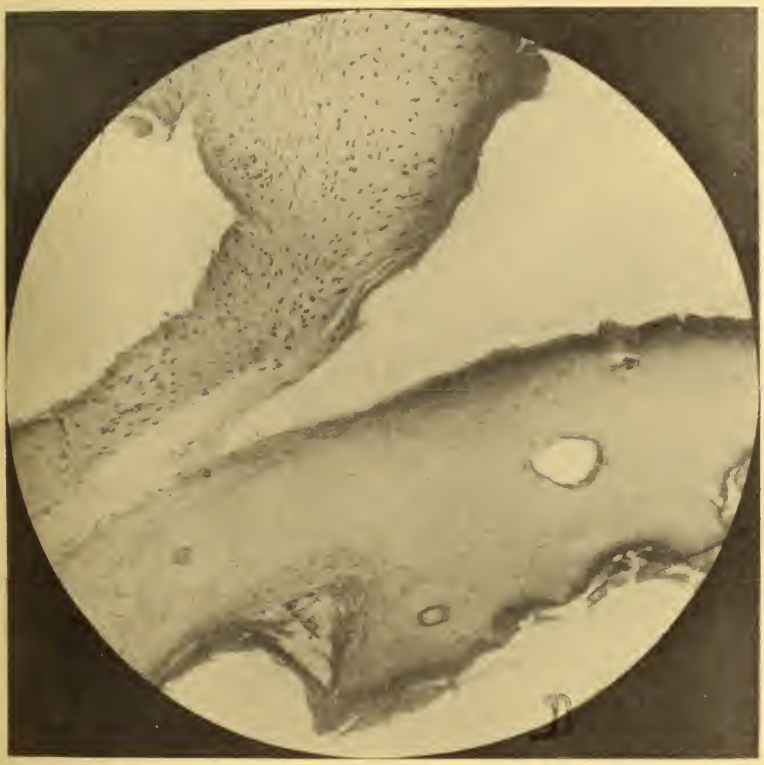

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Fig. 3.—Case IV. Illustrating the use of a transplant which slipped out of upper fragment eight days after being inserted while changing a cast. Second operation performed fourteen months later. At this time the transplant (*a*) was firmly attached to the upper end of the lower fragment. The tip of the transplant was vivified and forced into the upper fragment. Lane plate used for fixation. Solid union occurred in three months (*b*). Section through tissue from upper end of transplant not contacted with bone shows that the cortical bone is being substituted from the surface of the graft (*c*).

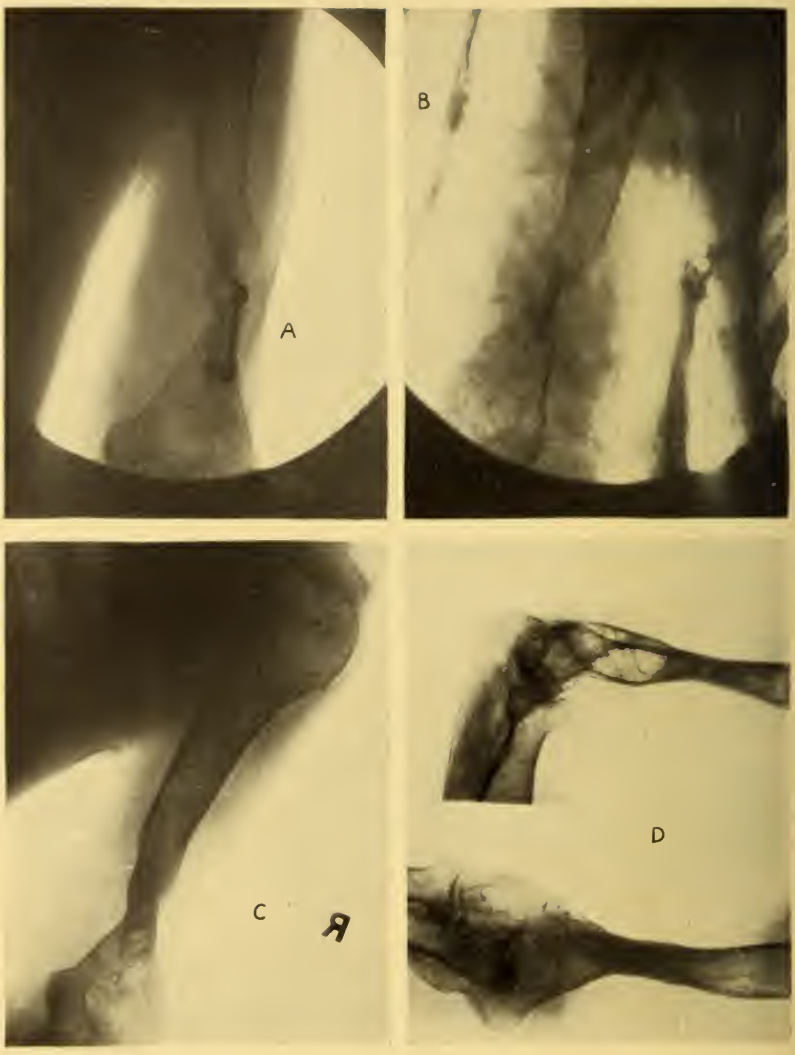

Fig. 4.—Gunshot wound of right humerus with loss of substance. Many previous operations for non-union. Marked atrophy of fragments. Bone transplant fractured at point where screw of plate had passed through. Lower end of this fragment of transplant firmly united with lower fragment. At a later operation this transplant was inserted into medullary cavity of upper fragment and fixed with chromic catgut. Union of fracture, with rapid increase in size and density of the bone at the point of insertion of the transplant. History given under Case V.

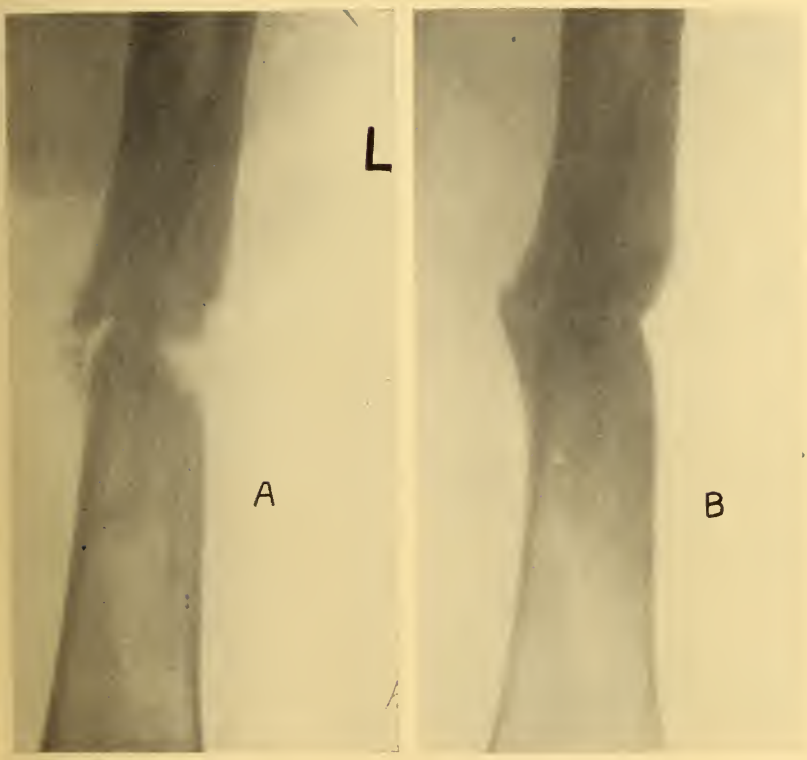

Fig. 5.—Intramedullary graft inserted after third attempt to correct non-union of fracture of the femur. Infection followed by fracture of the transplant and sequestration of its upper fragment. Sequestrum removed at operation. Upper end of lower fragment of transplant vivified and forced into medullary cavity of upper fragment. Suppuration ceased after removal of sequestrum of transplant. Union of fracture occurred rapidly. History given under Case VI.

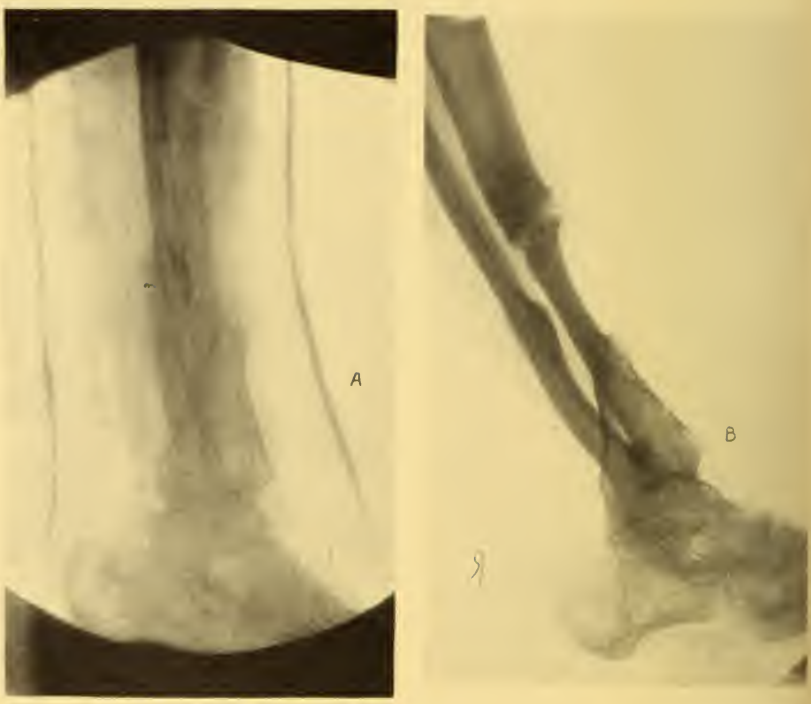

Fig. 6.—Bone transplantation to repair defect in the tibia following loss of substance. Appearance of transplant eleven years after insertion. Transplant has changed some in size, and has apparently changed in shape. Density of transplant like that of upper fragment. Marked atrophy of lower fragment. A pseudarthrosis has developed between upper end of transplant and upper fragment. Patient gets about so well that he has not desired operation to correct pseudarthrosis. History given under Case VII.

two freight cars and fractured at the junction of the middle and upper thirds. The left tissues were bruised an lacerated, but the fracture was not compound. The soft tissues were, however, so badly bruised that no attempt was made to immobilize the fragments for twelve days. A plaster-of-Paris cast was then applied, but when removed no union had occurred. After three months, an operation was performed to correct the non-union. The fragments were wired together after the scar tissue between them had been removed. After three months there was no union and another operation was performed.

On admission to the hospital, in 1915, nine years after the fracture occurred, a false point of motion was found in the left humerus at the junction of the middle and upper thirds. No callus was found. The silver wire inserted at the previous operation was found on roentgen-ray examination to be broken up into many fragments.

When the fracture was exposed, a distinct joint, containing fluid resembling synovia stained black by the silver wire and villi, was found. At this operation, the capsule was dissected away and the atrophic ends of the fragments resected. A transplant removed from the anteromedial surface of the tibia was inserted into the marrow cavities of the fragments and fixed with ivory pegs. Eight days later, while changing the cast, the transplant slipped out of the upper fragment.

The patient was seen from time to time, but the transplant was not contacted with the upper fragment and no union or callus formation occurred.

Fourteen months after the operation just mentioned, the patient returned to the hospital. The fracture was again exposed. The transplant had united firmly with the upper end of the lower fragment. The upper end of the transplant was vivified with bone-cutting forceps and passed into the marrow cavity of the upper fragment, which had been reamed out. A small Lane plate was then applied

to fix the fragments, for I believed that insufficient immobilization had permitted of a longitudinal displacement of the fragment, and that this had been an important factor in the non-union. Union had occurred at the end of three months. The patient has had full use of his arm since.

Case V.—N. J., aged thirty-three years, was admitted to the hospital, June 1, 1920. He was wounded, September 28, 1918, in the Argonne, a piece of high explosive striking him in the right arm. He was operated upon forty hours afterward, several pieces of bone and the fragment of high explosive being removed. The musculospiral nerve was injured. This was repaired, August 11, 1919. The function of the nerve has been completely reëstablished.

A roentgen-ray examination reveals considerable loss of substance of the humerus and marked atrophy of the fragments. The atrophy is especially marked in the lower fragment. Several operations, which had been previously performed to correct the non-union, had been unsuccessful.

On June 4, 1920, the fracture was exposed and the atrophic ends of the fragments removed. A graft taken from the anteromedial surface of the tibia was prepared and used as an inlay in the upper fragment and as an intramedullary graft in the lower. It was difficult to secure fixation, and a small Lane plate was applied. The wound healed without any inflammatory reaction. A later roentgen-ray showed that one of the screws used to fix the plate had been placed in the upper part of the graft which had been fractured. Immobilization was continued for some time, but, as union did not occur, another operation was performed six months later. The plate was removed. The lower end of the transplant had firmly united with the upper end of the lower fragment. The upper end of the transplant was vivified and united with the lower end of the upper fragment, which had been previously freshened, with chromic catgut. Fixation was obtained by a plaster cast. Union occurred

rapidly, but because of the small size of the graft, which had been used, immobilization was continued over six months. The graft is increasing rapidly in size and strength. The patient now chops wood and uses this arm in rather heavy work.

Case VI.—G. W., aged twenty-three years, was injured while in France, on September 18, 1918. He sustained a simple fracture of the left femur with severe contusions of the soft tissues when a tree fell on him. The fracture occurred at the junction of the lower and middle thirds. A Thomas splint was applied and worn until November 15, 1918. When this was removed, considerable overlapping of fragments was noted.

On March 25, 1919, an attempt was made in an army hospital to correct the deformity, a Lane plate being applied. Infection developed. On August 7, the plate was removed. No union had occurred, although the patient was up and about, using a caliper splint.

On June 30, 1920, another operation was performed for non-union, an intramedullary graft being employed. Infection developed and persisted, a sinus leading down to the transplant was present when the patient entered the Presbyterian Hospital on December 26. Two days later the fracture was exposed. The transplant had broken. The upper fragment of the transplant had formed a sequestrum following the infection. The sequestrum could be easily seen in the roentgen-ray. This was removed and the lower fragment of the transplant, which had firmly united with the lower fragment, was forced into the upper fragment and fixed with catgut. The wound was closed without drainage, enough space being left between the stitches to permit of drainage. Infection, very mild, developed, but the products of the inflammatory process escaped between the stitches, and no drain had to be inserted.

Firm union was secured within four months, with heavy callus formation, and has continued.

These cases are reported to show the efficacy of old transplants which have been displaced, become broken or infected. In each case, part of the transplant had become firmly united with one fragment. Substitution had gradually taken part in a considerable part of the graft, so that when the graft was employed again it was viable bone. The substitution had taken place in part from the graft itself. The osteoblasts on the surface of the graft had taken an active part in substitution.

In the first case, insufficient immobilization had, I believe, played an important part in the non-union, and for that reason a small Lane plate was applied. This procedure is generally advised against and should only be employed in exceptional cases where strict immobilization is desired. Such may be obtained by the massive graft, but the reparative process is much slower in massive grafts than in those which contain a minimum of compact bone.

THE RECONSTRUCTION OF BONE AFTER LOSS OF SUBSTANCE

In this group of cases, a transplant was inserted to correct loss of substance. They vary considerably, for in some cases the periosteum was preserved to some extent. Although at some points there was apparently a complete interruption, in other cases there were undoubtedly some fragments of bone displaced throughout the tissues into which the graft was inserted. It is difficult to say what part these fragments played in the repair of the defect after the graft had been inserted.

Case VII.—C. L., aged forty years. On November 1, 1910, he sustained a fracture of both bones of the right leg

in a motorcycle accident. The fracture was reduced and the fragments united with catgut. Later, the lower fragment became displaced and silver wire was used to fix it. Infection developed and two months after the accident the large intermediate fragment was removed. The patient has worn a brace ever since.

An examination made on his admission to the hospital revealed a decided limitation of motion of the ankle-joint, a long scar over the anterior surface of the lower third of the leg where the loose fragment had been removed and a defect in the tibia. The roentgen-ray showed the defect and also a marked bone atrophy most pronounced in the lower fragment.

On November 16, 1912, the fracture was exposed and the fibrous tissue between the fragments removed. A long bone transplant removed from the anteromedial surface of the tibia and used as an inlay in the upper fragment and an intramedullary graft in the lower was inserted.

A cast was worn for some time and then a brace. Finally this was discarded. The patient has walked upon the leg for over ten years without any support. He uses a cane. Fibrous ankylosis is still present in the ankle-joint.

This graft has changed some in form, but it has not increased much in size. A pseudarthrosis has become established at the junction of the upper end of the graft with the upper fragment. The union between the lower fragment and the graft is firm.

The patient gets about so well that he has never desired another operation designed to correct the false point of motion.

Case VIII.—R. W., aged twelve years, fell from a tree, October 20, 1914, receiving the full force of the fall upon the extended hand. He sustained a compound fracture, the radius separating at the lower epiphysis and being forced through the skin of the anterior surface of the forearm.

The fracture became infected a week after the accident and drainage was established to the lower end of the radius. On November 12, because of continued temperature and pain, several incisions were made in the palm and forearm. Considerable pus was found in both. When examined, the right forearm was considerably swollen. A sinus which led down to bared bone was found on the outer surface of the forearm; about two inches below the elbow was another sinus, which led down to the radius. Two incisions were also found in the palm of the hand from which considerable pus is discharged. The temperature was high; the general condition of the patient poor.

The patient was operated upon, November 19, 1914. The sinus above the wrist upon the anterior surface of the forearm was widened and the white necrotic portion of the radial shaft exposed. Separation had taken place at the lower epiphysis. When the bone had been extruded, the periosteum had been stripped. A tubular sequestrum of about one-half of the shaft of the radius was removed. As there was no evidence of repair in the lower part of the radius, a transplant, measuring about four inches in length, was removed from the anteromedial surface of the tibia and inserted into the defect. This was placed in the periosteal sheath and contacted below with the epiphysis of the radius. The wounds were partially closed. A small iodoform gauze drain was placed at the lower end. The incisions in the palm were widened to permit of better drainage. The temperature subsided soon after this operation and the wounds healed rapidly without extrusion of bone. Some weeks later, after the wounds had healed, the boy returned to the hospital and the ulnar nerve, which had been severed by the protruding bone at the time of the fracture, was sutured. No marked improvement following nerve suture has been noted.

Roentgen-rays, taken from time to time, indicated an increase in size of the bone graft and marked proliferative

changes in the periosteal sheath surrounding it. The epiphyseal cartilage had been destroyed. As a result, the radius is markedly shortened, but a synostosis developed between the radius and the ulna. As a consequence, the ulna has grown past the carpal bones, causing little, if any, radial deviation of the hand.

Case IX.—T. S., aged twenty-five years, was admitted to the Presbyterian Hospital, July 23, 1913. Nine weeks before admission, while supervising the erection of a water tank, in Oklahoma, the supporting framework gave way and the tank fell. The patient fell from a height of about fifty feet, and sustained a compound fracture of both bones of the forearm. The fracture was plated at a local hospital and an infection developed. When examined at the hospital after admission, the plate on the ulna was exposed, being at the level of the skin. Several sinuses on the radial side of the forearm led down to the plate used to fix the fragments of the radius. A roentgen-ray revealed a sequestrum of the radius which extended well above the plate.

An operation was performed, July 25, 1913. The plate on the ulna was easily removed, together with several small pieces of bone. Several small necrotic fragments were removed with a sharp spoon. An incision was then made on the radial side of the forearm in line with the old scar and the plate removed from the radius. The sequestrum in the radius, about which there was little, if any, evidence of bone regeneration, was also removed. So much bone had been removed from the radius that subsequent radial deviation of the hand was feared. For this reason a transplant was taken from the anteromedial surface of the tibia and placed in the defect. For even if it had to be removed later, it would have served a useful purpose in preventing, to some extent, this radial deviation of the hand. The transplant was fixed by small ivory pegs.

The wound was closed, enough space being left between the stitches to permit of drainage of pus if such developed. Later, two small sinuses formed. One of the small ivory pegs was discharged. Later, several small fragments of bone were discharged. Some were removed but the graft remained *in situ*.

Union has occurred between the fragments. Although there is considerable deformity, this patient has again taken up bridge building and carries on his work without any great amount of inconvenience.

Case X.—S. G., aged thirty-two years. On January 30, 1916, while skiing, the tip of the ski caught and the patient sustained a spiral fracture of the right femur. Three days later the fracture was exposed and two circular wires were passed about the fragments, fixing them in position. Six weeks after the operation a purulent discharge was noted, which later became serous. This continued intermittently until ten days before the patient was admitted to the Presbyterian Hospital on April 24, 1916.

A roentgen-ray, taken at this time, showed the wires in position and necrosis of the long lower end of the upper fragment. The patient was operated upon, May 15, 1916. The fracture was exposed, the wires and sequestrum removed and a transplant measuring seven inches in length taken from the anteromedial surface of the tibia inserted. This was used as an intramedullary splint in the lower fragment and an inlay splint in the upper. A body cast was applied after the wound was closed.

Immobilization was continued for five months. Some deformity developed in this case, for the lower fragment was not sufficiently abducted to be kept in line with the upper. In spite of the bowing, which has occurred with the accompanying shortening, the full use of this extremity has been restored.

Fig. 7.—Recent infected compound fracture. Sequestrum of radius removed. Transplant inserted in presence of infection. Transplant survived. Rapid formation of bone from remaining periosteum. Rapid increase in size of transplant. Appearance of radius eight years after operation. Radius reconstructed. Epiphyseal growth retarded. Synostosis between radius and ulnar. Ulna has grown by carpus. There is consequently no radial deviation of the hand. History under Case VIII.

Fig. 8.—Compound infected fracture of both bones of forearm. Lane plate and sequestra removed. Bone transplant placed in defects in bone in presence of infection. Later several small sequestra were extruded. Healing occurred. Appearance of fracture eight years later. Deformity quite marked. Patient has resumed heavy work, being a bridge builder. History under Case IX.

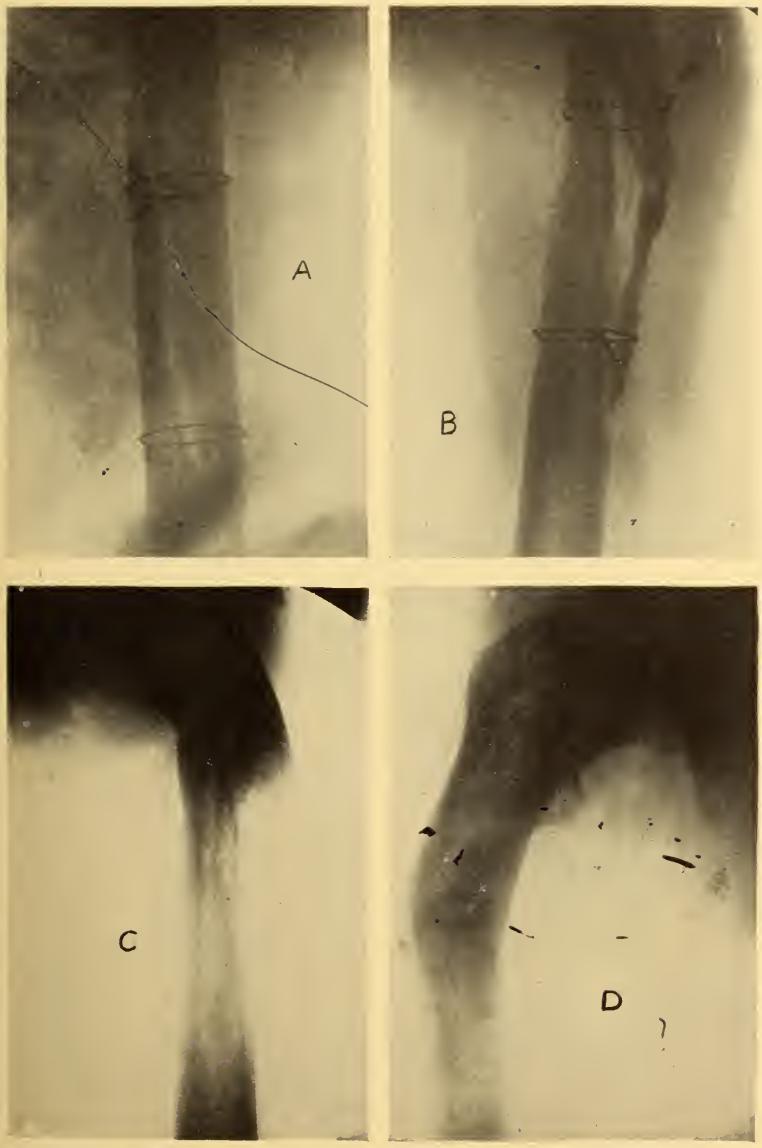

Fig. 9.—Spiral fracture of femur occurring while patient was skiing. Fracture wired. Infection occurred followed by sequestration of fragments. Transplant inserted. Appearance of fracture five years after bone transplantation. Some shortening of extremity due to abduction of upper fragment. History under Case X.

Fig. 10.—Malunion of fracture of radius following fracture between insertions of supinator and pronator radii teres. Defect remained in bone when fracture was corrected and fixed by plate. A piece of the fragmented bone was inserted into the defect. This fitted so snugly that no fixation was necessary. Rapid increase in size of fragment with union. History under Case XI.

Fig. 11.—Non-union due to separation of fragments by a Lane plate. Intramedullary bone transplant inserted. Transplant absorbed. Union has occurred as a result of periosteal callus. History under Case XII.

FIG. 12.—Non-union of femur due to separation of fragments. Heavy callus followed plating of fracture three months after injury. Failure of union with absorption of callus. Plate removed. Bone-grafting later resorted to. Absorption of graft with no union. Heavy bone-graft then inserted combined with fixation by a small plate. Firm union. History given under Case XIII.

Fig. 13.—Non-union of the humerus. Compound infected fracture. Intramedullary bone-graft inserted. A large amount of callus developed after this operation but non-union followed absorption of graft and callus. Another operation was not entirely successful.

Fig. 14.—Massive graft in the treatment of non-union.

Case XI.—F. D., aged fifty years, fell, December 29, 1919. She tripped and fell forward upon her right hand in attempting to break the fall. A roentgen-ray taken the next morning revealed a fracture of the right radius between the insertions of the supinator and pronator radii teres. An immobilizing splint was worn for four weeks, with the hand in a position midway between supination and pronation. When the dressings were removed the patient experienced severe pain at the site of the fracture and in the wrist-joint. This pain is increased by motion and is severe enough to keep her awake or to awaken her when asleep. Supination is lost, for union has occurred with the upper fragment in supination and the lower in pronation.

The patient was operated upon, April 2, 1920. The fracture was exposed by an incision on the outer side of the right forearm, which was made through the intermuscular septum. In breaking up this union a comminuted fragment of bone, which may be seen in the roentgen-ray, was removed. When the lower fragment was supinated to bring it in line with the upper, a defect existed in the radius. The fragment of bone which had been preserved was forced into the defect, the fragments having been previously fixed with a small Lane plate. After full supination to bring the fragments in line and some flexion to release the pull of the biceps, a cast was applied. The fragment of bone, which had been inserted into the defect, increased rapidly in size and the shaft of the radius was quickly restored. The pain rapidly disappeared from the forearm and wrist, and the power of supination and pronation has been restored.

NON-UNION DUE TO SEPARATION OF FRAGMENTS

Case XII.—W. L., aged thirty-five years, was admitted to the hospital, February 19, 1916, and discharged, March 4, 1916. This patient sustained a fracture of the humerus

in November, 1915. He was at work at a twenty-six-inch emery wheel when it broke. The right arm was struck by a large piece of the wheel and he sustained a compound fracture of the lower third of the humerus and an injury of the musculospiral nerve. Some of the nerve was torn away, so that a considerable defect remained. Circular casts and ordinary splints were applied from time to time, but union did not occur. Five weeks before the patient entered the hospital, a Lane plate was applied. The fracture did not unite and a roentgen-ray taken when the patient entered the hospital showed that there had been no attempt at union and that no callus had formed. Non-union in this case was undoubtedly due to separation of the fragments in the longitudinal axis. The plate had been applied when the fragments were separated. An intramedullary graft was inserted in this case. A fascial tube was used to repair the nerve. There has never been any restoration of nerve function.

Union of the fracture occurred after four months. The roentgen-ray indicates that union in this case has been in greater part due to the periosteal callus, which is most marked on the posterior surface of the humerus. This has developed to quite an extent. The union in this case has been firm and the patient has taken up his former work.

Case XIII.—W. R., aged seventeen years, fell from a tree in August, 1922, and sustained a fracture of the right femur. A cast was applied. This was removed at the end of a week and then extension was employed for six weeks. The patient was then permitted to walk on crutches. On November 1, he fell while going down stairs and re-fractured the femur. Nothing is known regarding the union in the interval. When brought to the hospital there was marked shortening of the right lower extremity and considerable deformity. A roentgen-ray picture showed that the ends of the fragments were widely separated and that there had

been an attempt to form callus in the tissues between the fragments.

An operation was performed on November 5, when the fragments were separated from the tissues surrounding them and approximated. The ends of the fragments were sclerotic and covered with fibrous tissue, indicating that they had been much more widely separated and for a longer time than might be expected from the history which was given. When the fragments were approximated, they were fixed with a Lane plate. Subsequently, an enormous callus developed at the site of the fracture. This callus gradually grew smaller, but did not become denser. After twelve weeks the Lane plate was removed, a caliper splint applied and the patient encouraged to walk.

Non-union still persisted, and after six months another attempt was made to secure union. The fracture was again exposed. A transplant taken from the anteromedial surface of the tibia was used. This transplant gradually absorbed and non-union again occurred. The callus upon the inner side of the femur had by this time become converted into bone, but it was attached to the lower fragment alone and did not bridge the fracture and played no part in the union.

Seven months after this operation another operation was performed to correct the non-union. The fragments in the roentgen-ray had a peculiar spongy, soft appearance. When exposed at operation, however, they seemed to be fairly firm. At the last operation the fibrous tissue was removed from between the fragments and a massive graft, removed from the crest of the tibia, was used as an inlay, being fixed in position with catgut. In order to secure good fixation in this case, a small Lane plate was inserted. The cast was removed at the end of twelve weeks, at which time union had occurred. The patient was advised to wear a caliper splint for some time, to prevent re-fracture.

It is quite probable in this case that injury to the nutrient

artery was an etiological factor in the non-union, for the fracture occurred close to the nutrient foramen and the displacement was so great that the artery would necessarily be torn. It is difficult to determine the cause of the failure of the large callus, which developed in this case, to form bone. Spaces gradually developed in different parts, and the callus became absorbed in greater part. This may have been due to some interference with the blood supply of the periosteum, following extensive injury to the soft tissues, as a result of the wide displacement of the fragments.

Firm fixation was, I believe, an important factor in securing union in this case, and, while fixation might have been attained by a massive graft, it was thought best to insert a small Lane plate, a procedure which is to be adopted in exceptional cases only.

Case XIV.—H. P. twisted his left leg while skiing. He experienced a severe pain in the right thigh, and, when it was examined, it was found that he had a fracture at the junction of the middle and lower third. This fracture was reduced and a body cast applied. Reduction was not good and later a Thomas splint was applied. No union occurred and later the fragments were exposed, the fibrous tissue between them removed and the fragments when reduced were fixed with a Lane plate, about which circular silver wires were applied. A body cast was applied. Union occurred rapidly after this operation.

Non-union may occur when the fragments are in perfect alignment. It has been said that there is an inherent tendency to non-union in fractures of the lower third of the tibia, although apposition is perfect. The line of fracture in such cases is usually transverse or slightly oblique, without displacement. It is difficult to account for non-union in such cases. The relationship of vascular supply to callus formation and the conversion into bone must be

considered more carefully. A disturbed vascular supply may have some relation to non-union in such cases.

Non-union in which there has not been much displacement of fragments has been observed in 17 cases, and only 2 illustrative cases will be cited:

Case XV.—M. K., aged thirty-five years, sustained a fracture of the left leg while working in a coal mine. The fracture was reduced and immobilized, but when the cast was removed there was some deformity. When he attempted to walk he experienced considerable pain at the site of fracture, where there was a distinct false point of motion. Considerable pain could be elicited by pressure over this point. Union had not occurred in this fracture after four and a half months.

A roentgen-ray examination revealed an oblique fracture of the left tibia, with some overriding. An operation was performed to correct the non-union. The fracture was exposed. The ends of the fragments and the intervening fibrous tissue removed and a transplant, taken from the anteromedial surface of the opposite tibia, was used as an inlay graft. This graft, which was laid in the gutter which had previously been prepared for it, was fixed with two small steel wire nails. A plaster-of-Paris cast was applied after the wound was closed. Subsequently, these nails were removed. Union occurred within four months, with disappearance of the pain. The function is now practically perfect.

Case XVI.—E. E., aged twenty-five years, was injured, March 10, 1917, while crossing a railroad track. He was struck by a switch engine, the footboard of the engine striking the legs. He was knocked unconscious and remembered nothing until picked up. He had sustained a fracture of both bones of the legs in the upper third. The fractures were reduced, but almost four months later there

was a false point of motion at the site of each fracture. The fractures were exposed, the fibrous tissue removed, the ends of the fragments vivified and a transplant, taken from the anteromedial surface of the tibia, was placed across the fracture and fixed in position by catgut. A circular cast was applied. Union occurred rapidly.

Case XVII.—L. S., aged thirty-three years, was injured in June, 1920, while firing a locomotive. While walking into the tender, he stepped into a hole, fell and broke both bones of his right leg. There was not much displacement of fragments and a circular cast was applied. Union of the fibula occurred, but a false point of motion persisted in the tibia. Pain was experienced at the fracture when the patient walked and there was always considerable tenderness. A cast was applied when the patient entered the hospital, but soon after the roentgen-ray examination which revealed a transverse fracture in which union had not occurred, it was decided it would probably be best to perform a transplantation of bone. Some days were, however, permitted to pass before the operation was attempted, to see if the union became more firm.

The operation was performed, February 10, 1921. The fracture was exposed, the fibrous tissue between the ends of the fragments removed. The thickened periosteum was divided longitudinally and reflected, and the ends of the fragments vivified. A transplant, taken from the anteromedial surface of the lower fragment, was placed across the fracture, being laid in a gutter previously made in the upper fragment. The periosteum was then sutured over the transplant. The skin was closed with silk and a circular cast applied. Union had occurred within twelve weeks and the patient has resumed work.

Non-union occurring in the type of fractures under discussion is readily corrected by bone transplantation or by comminution of the fragments combined with overlapping.

In the following cases union has not been obtained. Further operations have not been desired by these patients. In two cases the cause of the non-union is quite obvious; in one it is difficult to determine.

Case XVIII.—N. L., aged twenty-two years, was wounded in the Argonne, September 15, 1918. He was struck by a piece of high explosive and a segment of the upper part of the right tibia was blown away, the fibula not being fractured. The intact fibula prevented the apposition of the fragments. An operation was performed on October 18, 1920, to correct the non-union. A delicate but very adherent scar was found at the site of fracture. In exposing the fracture, this scar was interfered with as little as possible, because of previous experiences with scars of this kind following war wounds, which frequently literally melt away when the underlying tissues are separated.

The upper part of the fibula was fractured, after the scar tissue, between the fragments of the tibia, had been dissected away, exposing somewhat sclerosed, but fairly good bone. Division of the fibula permitted of fair approximation of the fragments. Small fragments of bone removed from the fibula and the fragments of the tibia were implanted between the vivified ends of the fragments.

The non-union is much less decided than before the operation. There is, however, some motion between the fragments. The patient wears a brace and gets about very satisfactorily. The fibula should have been resected in this case to permit of better approximation of the fragments, and the ends of the fragments should have been resected to a great distance. More caution than necessary was probably exercised in this case because of the adherent scar at the site of the fracture.

Case XIX.—E. C., aged forty-one years. Both bones of the left forearm were fractured, January 10, 1919. The

fracture was compound, the ends of both bones protruding through the wounds in the soft parts. A plaster cast was applied. This was worn for five weeks. Then a sling was worn for some four months. This fracture became infected and several small fragments of bone were discharged from the wound.

A roentgen-ray examination revealed non-union of the lower part of the radius, the upper end of the lower fragment of which was markedly displaced toward the ulna.

On November 11, the fracture was exposed, the ends of the fragments of the radius were dissected out of a dense scar tissue and fairly well approximated. A transplant taken from the anteromedial surface of the tibia was inserted into the medullary cavity of the lower fragment and used as an inlay in the upper fragment. The transplant was fixed with catgut and a circular cast applied. The wound was clean when the stitches were removed. Some time after the patient went home an infection developed in the wound and several small spiculæ of bone were discharged. The transplant was absorbed. Although the patient still has some motion in this fracture, he is able to carry on his work, which is rather heavy.

The absorption of the transplant in this case was probably due to the infection. The difficulty of maintaining the fragments in line may have been a contributing cause. The direct pull of the pronator quadratus upon this fragment is difficult to overcome.

Case XX.—C. U., aged fourteen years, was admitted to the hospital, February 2, 1920. He had been injured in November, 1919, falling from a train and sustaining a fracture of the right humerus in the upper third. This fracture, which was compound, became infected. Several small scars indicate the position of sinuses, now healed, through which pieces of bone were extruded. The fracture was immobilized for five weeks immediately after the injury. Accord-

Fig. 15.—Non-union of a compound infected fracture. Union secured by bone-graft. Refracture occurred later at same level. Union occurred after second fracture after immobilization in a cast. Amputation was performed several years later for osteomyelitis which, according to the history, developed rather acutely.

Fig. 16.—Non-union of simple fracture of the tibia. Union quickly followed insertion of transplant.

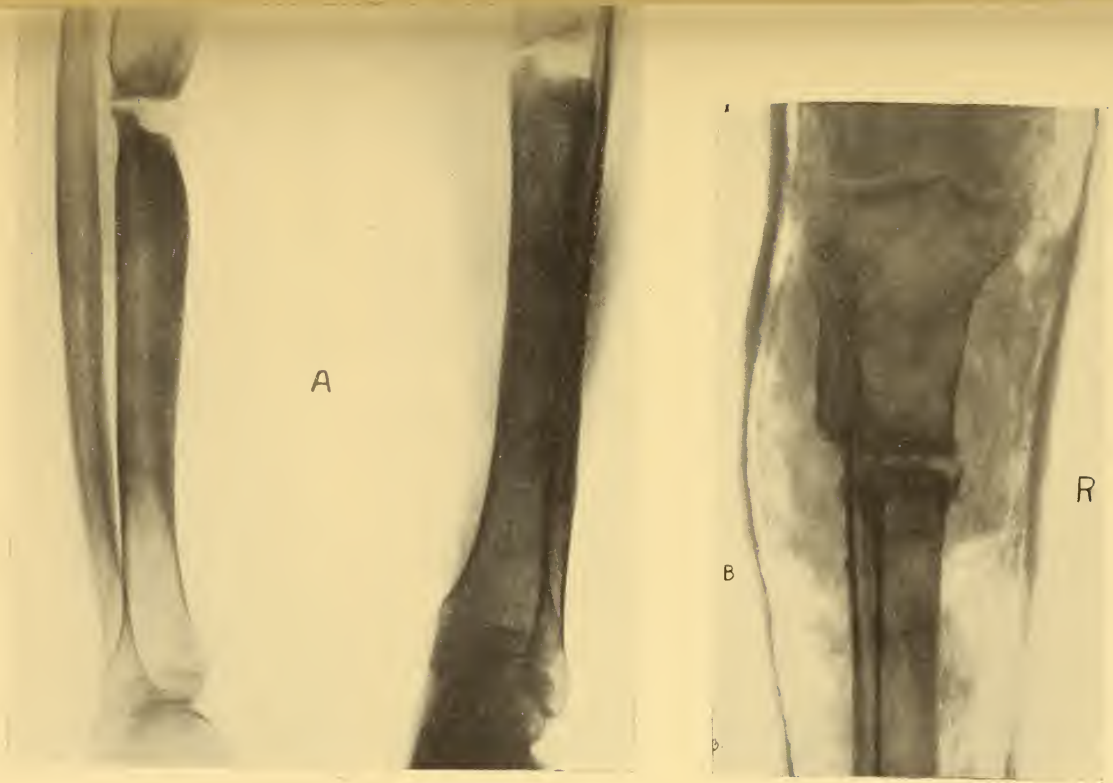

Fig. 17.—Non-union of tibia following gunshot wound. Non-union due to the separation of fragments resulting from loss of substance of one of parallel bones. Fibula fractured and ends of bone vivified. Small fragments of bone implanted at seat of fracture. History given under Case XVIII.

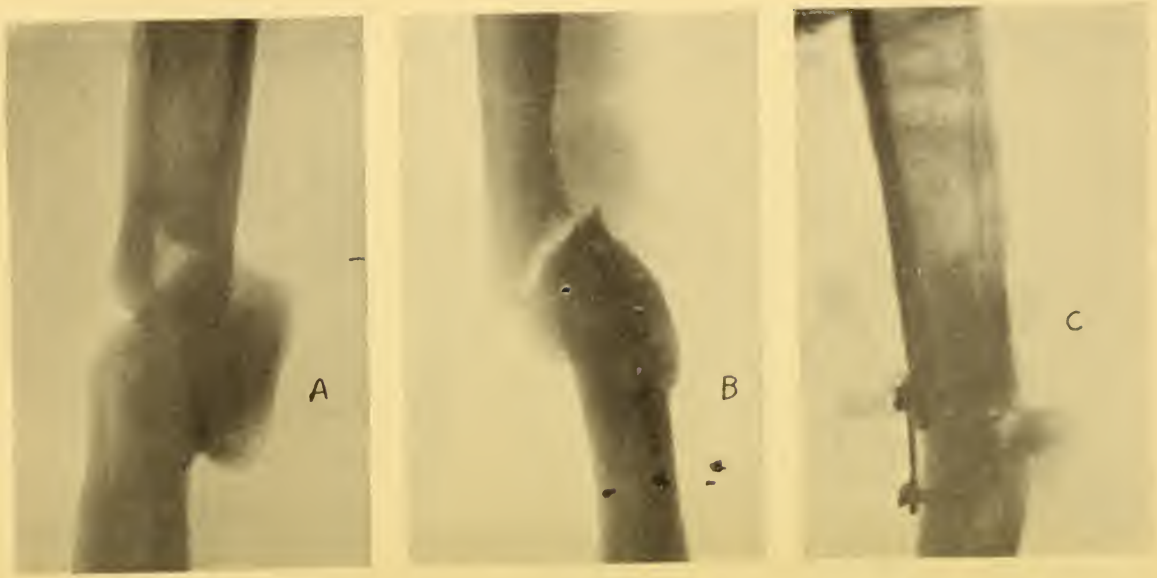

Fig. 18.—Non-union of humerus. The callus in this case seems to have developed below the site of fracture, for the upper end of the lower fragment is surrounded by bone below the fractured surface. Union occurred rapidly after the insertion of an intramedullary transplant and fixation by a small Lane plate.

ing to the patient's statement, there was some union of the fracture when the patient left the hospital.

A roentgen-ray indicates that there has been no attempt at repair. The ends of the fragments are atrophic.

The patient was operated upon, February 4. The ends of the fragments were exposed and the scar tissue between them removed. The ends of the fragments were then exposed until healthy bone was found. A transplant taken from the anteromedial surface of the tibia was removed and used as an intramedullary graft. A technical error was made in this case in that the transplant was not placed far enough into the cavity to permit of approximation of the ends of the fragments. This separation was not especially noticeable at the operation, but was distinctly marked when the roentgen-ray picture was taken later. Considerable callus apparently formed about the fracture, but this became reduced in size and non-union gradually become more and more pronounced, the bone transplant being gradually absorbed. Attempts were made to secure union by various methods which have been advised, but non-union persisted.

Somewhat over a year later another attempt was made to secure union. The fracture was again exposed and the ends of the fragments resected so that they could be overlapped. They were then united by chromic catgut. The wound was closed in the usual way and a cast applied, an attempt being made to secure firm fixation.

The cast was removed after three months, at which time considerable union had occurred. This patient has returned to work and desires no further operation.

Failure of union after the first operation was probably due to failure of direct apposition of the ends of the fragments. This separation, which should have been noted, was overlooked. It is difficult to determine the cause of non-union after the second fracture.

In the cases just reported, insufficient immobilization

and longitudinal separation of the fragments have played an important role in the non-union. These factors are most frequently encountered in non-union of the humerus. Wide displacement of the fragments in the anteroposterior diameter with a complete tear of the periosteum is not infrequently the cause of non-union, the separation of the fragments rather than the intervention of soft tissues being the cause of it. After the fragments have been separated for some time their ends become sclerosed. This change in the ends of the fragment becomes an added factor to be considered in the non-union.

Loss of substance affecting one of two parallel bones is naturally much less common in civil life than during war.

Interference with the nutrient artery or with the periosteal vascular network, which develops to such an extent during the repair of a fracture, is probably more frequently a factor in non-union than is generally supposed. In fractures of both bones of the leg without much displacement and in fractures of the tibia in which the alignment is almost perfect, non-union is not infrequent. Lexer has recently suggested that in these cases motion, which is permitted later, should be instituted early. Late motion tends to develop the same type of fibrous tissue which already occupies the gap. Early motion tends to develop the vascular supply, which increases following fractures, upon which definitive repair depends. In fractures of this type it would probably be well to permit of some motion during the first three weeks and from then on to immobilize as perfectly as possible the fragments. Such a procedure, the reverse of that usually employed, would favor the development of the vascular supply and tend to prevent the reproduction or increase of the fibrous tissue by immobilization.

In reviewing the work of different investigators, it is evident that there is considerable difference of opinion concerning the life history and fate of bone grafts. Leriche

and Policard do not believe that the bone graft is a true graft, as this term is generally employed, for, according to them, bony tissue always dies. Elimination, toleration or absorption of the graft always occurs according to them. Most of the statements, such as the above, are based upon histological examination of bone grafts, and in most instances they are based upon study of sections taken at some distance from each other and not upon serial sections of the graft.

It must be admitted that the greater number of cells in a graft die, death being dependent upon the physical characteristics of the graft. Death of cells also occurs in skin and tendon and fascial transplants, but substitution goes on from the graft proper and not from surrounding tissues.

Certain changes may occur in graft which I believe indicate that parts of the graft remain viable from the time that it is inserted. Sequestration supports the above statements. Not infrequently, sequestration occurs in infected grafts. It occurs early, before substitution of the graft from surrounding tissues could have occurred. Separation of dead tissue cannot occur unless there is adjacent living tissue, and sequestration seems to me to furnish incontrovertible evidence that parts of the graft remain viable from the time that it is inserted.

Autogenous bone transplants give the best results in the treatment of the non-union of fractures. If the bone graft invariably dies, boiled autogenous bone, beef bone or horse bone should give the same results as the autogenous bone graft in bridging defects and in the treatment of non-union. Dead bone, even when autogenous, does not give the same results. According to Leriche and Policard, dead bone should give as good results as fresh autogenous grafts, but it does not, because, according to them, beef and horse bone, which is usually used, is too thick and compact and resists vascularization too long.

The ideal graft is one which contains periosteum and endosteum and enough cortical bone to keep the form of the graft. The osteoperiosteal graft is capable of rapid regeneration, and were it strong enough to maintain some fixation, and such is not the case, would be ideal. The larger part of the massive grafts undergo necrosis and are more apt to fracture than the thinner grafts. Boiled bone may be indicated in some cases to maintain fixation in combination with an osteoperiosteal graft or thin graft containing cortical bone.

Absolute fixation is essential to the development of the graft in the treatment of non-union. In rare cases it may be necessary to use a Lane plate to obtain this. This will be required in exceptional cases only.

The graft should come in intimate contact with the bone in which it is implanted, so that no dead spaces will separate it from the host. Conditions which favor rapid restoration of circulation in the graft and its nutrition should be provided.

IMPORTANT CONSIDERATIONS IN THE TREATMENT OF FRACTURES OF THE SHAFT OF THE FEMUR

By Albert O. Singleton, M.D.
Galveston, Texas.

General surgeons have been for some years led away from the problem of fractures by other more attractive fields of surgery, but, fortunately, as a result of the war, which necessitated the highest development of treatment of fractures, a great stimulus has been given to this important subject, and, for this, praise should be given to the orthopedic surgeons chiefly.

Fracture work is very difficult work, and the surgeon who cannot take charge of his patients personally and attend to almost every little detail himself cannot be expected to secure good results. Pathologically, he should recognize that fractures are lacerated wounds of the bone and periosteum, with disturbance of the adjoining tissue, including ligaments, joints, muscles and possibly the bloodvessels and nerves, and that his problem must include not only the attention to the apposition of the bone lesion, but be directed to all the pathology associated therewith. The "setting" of the bones, or the apposition of the bones, is of primary importance, but due to the distribution of the muscle compensation and the recognized action and influence of the muscles upon the bones, it involves the "setting" of the muscles as well as the "setting" of the bones.

Proper reduction is of great importance, and the most

important factor in securing proper apposition of the bones is the time elapsing between the fracture and the time of reduction. I consider it of the utmost importance to recognize that early reduction means always easier and more accurate reduction. If this fact could be impressed upon the minds of the average surgeon sufficiently to make him treat fractures as emergency cases, the great difficulty of reduction would be frequently avoided. (There should not be such a thing as waiting for a suitable time to set the fracture.) If we secure proper apposition of the bones and maintain them, it means that the wound of the bone will heal by primary union, while the separation of the bone means secondary union or slow union and often excessive callus, and we have come to the belief that nonunion or malunion is most often brought about by poor reduction or improper retention of the bones.[1]

Also, we recognize or believe that open operation is not without danger and should be avoided except in extreme cases, and the more energetic the effort to reduce the fracture the fewer the cases which will require open operation. Because of the danger of infection and intolerance of the tissues to foreign bodies or nonabsorbable material, we should be content frequently with an imperfect apposition of the bone fragments when we feel that good function will likely result. This is probably more particularly true in children, in whom it is found that the natural restoration of function is more rapid and more complete than in adults. Further, it has been found in children that shortening in fractures of the femur will disappear in subsequent years by excessive growth of the injured bones.[1]

The deformity which regularly results with fractures at various places in the shaft of the femur are too well known to dwell upon. It is well known that in the upper third of the femur the upper fragment maintains an anterior and abducted position, while in fractures of the lower third the lower fragment is displaced backward into the popliteal

place. In the former the leg is put up in a flexed and abducted position, while in the latter the knee requires to be flexed in order to maintain the proper position.

For treating fractures of any part of the shaft of the femur the splint most universally accepted as being the most efficient is the Thomas splint. This splint lends itself by bending, or with an attachment on its under side, which will allow flexion of the knee, to the treatment of a fracture of any part of the shaft. Orb says:[2] "In fractures of the femur the Thomas traction splint has shown itself to be far more useful, both as an emergency splint and a splint for continued treatment, than any other mechanical device heretofore recorded. The Thomas splint allows the care of the soft parts and adjacent joints, the failure of which is rarely recognized."

A certain amount of traction or countertraction is advisable in all cases, whether in open or closed reduction, and regardless of the plan of fixation. If the fracture is transverse or irregular across, reduction may be accomplished and the position maintained with a moderate degree of traction or countertraction, but when the fracture is oblique a greater amount of traction is necessary Except in oblique fractures of the lower end of the femur, skin traction is usually satisfactory; but in the oblique fractures of the lower end of the femur, with overriding, sufficient extension cannot be secured except by skeletal traction. Therefore, the use of the pins after the method of Condivilla, of Italy, and Steinman, of Switzerland, or the tongs or calipers attached to the outside of the bone (Ransohoff's method or Beasley's ice-tong calipers) is highly desirable. These are extremely efficient and easy and safe to use and much superior to skin traction. The statement of Scudder,[3] "Direct bone traction brings most efficiently and accurately the efforts of traction and counter traction into action," expresses the opinion of practically all orthopedic surgeons at the present time. The amount of weight will have to be determined by

the results secured by the pull, but it is always wise to have a strong pull, and as early after the fracture as possible, so as to prevent the contraction of the muscles rather than having to lengthen the muscles by the pull after they have contracted. From ten to twenty-five pounds will be needed. It is needless to say that roentgen-ray pictures made with a portable machine must be used frequently to guide one into determining the amount and direction of the pull.

Because of the inability to reduce fractures, due to interposition of soft parts or other causes, some cases, despite one's best efforts, will need to come to open operation. An open operation should not be undertaken without a careful estimation of the ability and condition of the entire operating force and the proper respect for the difficulties which may be encountered. The procedure will invariably be more difficult than it appears, particularly if some time has elapsed since the injury, resulting in contracture of the soft parts and shortening of the limb.

Time will not permit me to discuss in detail the various methods of internal fixation and the relative value of each. We prefer not to use foreign material when it can be avoided, but plates, screws and bands all have a place, and it is well to be provided with such a variety and let the circumstances determine which to use. If these are used they should be considered only as temporary splints, and their removal is advisable after union has occurred. The intramedullary peg is probably not good to use, and in our experience has not been satisfactory. The plan of pointing one fragment and coning out of the end of the other and bringing them together, we have used in a number of cases, with a desire to avoid foreign bodies. These have all succeeded, but in each instance with a noticeably slow union resulting. In the oblique fractures with marked obliquity the Parham-Martin band is the most perfect mechanical device of which I am familiar for maintaining position, but it is not without danger. Slow union or nonunion does occur in some instances

where the obliquity of the fracture is not great, resulting in the band interfering with the nutrition of the ends of the bones.

I am strongly of the opinion that the poor callus and slow union, which are so commonly seen in openly reduced fractures in general, are due to the separation of the soft parts, chiefly muscles and periosteum, from the ends of the bones, thus interfering with the blood supply to them, by which alone bone can reform. Therefore it should be kept in mind that the method used to fix the bones together should be the one that requires the least amount of interference with the tissue about the ends of the bones.

Whether closed or open methods are used, I would like to emphasize again that early reduction of a fracture is desirable. Also, I would strongly urge the use of spinal anesthesia as the anesthetic of choice. The advantages of it over general anesthesia are many, and it is unquestionably safe, because not over $1\frac{1}{4}$ grains of novocaine is needed for securing anesthesia and relaxation in the lower extremities. Our practice is that, as soon as possible after the patient is admitted, before his clothing is removed, he is given an injection of $1\frac{1}{4}$ grains of novocaine intraspinally. This results in comfort to the patient, with all subsequent handling and manipulation and his coöperation in every way. He is immediately taken to the roentgen-ray room and roentgen-ray plates made and developed, or he is put under the fluoroscope. If the fracture is transverse to the degree that it makes it possible to approximate sufficiently to prevent the slipping apart of the ends of the bones, then the reduction under the fluoroscope is used. The Thomas splint is made ready and put on the leg before reduction, and then it is adjusted and fixed securely without disturbing the position of the bones after they are reduced. By this plan of procedure we have succeeded in a large number of cases in securing good apposition and maintaining it. But in those patients in whom considerable time has elapsed after

the fracture, we rarely succeed in correcting or improving the original deformity.

It is probably advisable to repeat that the care of the soft parts, including muscles, tendons and adjacent joints, should not be neglected. As soon as union is secured, ambulatory splints should be worn and weight-bearing avoided for several months. There appears to be a tendency on the part of the accident insurance companies and their surgical representatives to urge the use of fractured limbs entirely too early, not enough time being given for a complete recovery.

Summarizing I wish to say: 1. The early reduction of fractures of the femur under spinal anesthesia, with the aid of the fluoroscope or roentgen-ray plates, and by placing the splint in position before reduction, will succeed in a number of instances in securing and maintaining good position.

2. The Thomas splint is the splint of choice, with provision for flexion of the knee.

3. Extension is necessary in all cases, whether open or closed reduction, and whether or not plates or other methods of fixation of the bone are used. Skeletal extension or traction is superior to the skin when there is overriding of the fragments, particularly in fractures of the lower end of the femur.

4. It is important not to neglect the muscles, tendons and joints and allow them to suffer from disuse and atrophy.

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THE NEAR NORMAL RESTORATION OF A LIMB AFFLICTED WITH THE DISABLING CONSEQUENCES OF AN OLD POTT'S FRACTURE.

By Francis Reder, M.D.
St. Louis, Mo.

The difficulty encountered in an endeavor to restore to functional efficiency a crippled ankle-joint, the sequence of trauma, can only be apparent to one who undertakes it.

It is not so very unusual to see surprisingly good function after fractures of bones essential to joint formation that have been surgically neglected. A Colles fracture may be cited as an appropriate example. However, deformities are not without significance, and they may be of such serious degrees that compensatory muscular hypertrophies are inadequate for restoration of the normal physiological balance between the bones and their flexible stays.

A Pott's fracture deformity embodies many of the disappointments that have been unlooked for following the release of the limb from its splinting. The conformation of the structures about the ankle-joint may appear anatomically correct, the joint may exhibit a satisfactory mobility, the functional efficiency may appear promising, and during the first six months encouraging progress usually made with walking exercises.

This is generally a regular course of action with most fractures of the lower extremities. The time following the first six months, however, may find that some fractures of

the Pott's type, discharged as cured, are giving signs of failing efficiency. This evidences itself at first by fatigue and a dull, heavy pain in the foot and lower part of the leg.

Later the prescribed exercises are not indulged in with the former resolutions, but are generally continued in the hope of overcoming what appears to be only a temporary weakness of the ankle-joint. Eventually it will be noticed that the foot is assuming an everted position as more weight is brought to bear upon it, with the lameness more decided and the pain when walking more severe. Though it is apparent to the patient that the condition is not improving, many will continue in this plight for a long time wholly incapacitated to do any work.

What is the reason that this class of fractures should give such an unpromising result? Is it the severity of the trauma or is it surgical neglect? In the first place, permit me to define a Pott's fracture. The present teaching is prone to "lump" many of the fractures about the ankle as Pott's, or a modification of Pott's. Such teaching is not conducive to the best interests of those who do not specialize in this branch of surgery, and will show itself in the end-results, the sequence of improper treatment. A Pott's fracture is always an abduction lesion. It is a definite entity with characteristics that have linked the name of the great St. Bartholomew surgeon with this trauma ever since he gave us his discription in 1779. In simply noting that a Pott's fracture consists of a fracture of the lower end of the fibula not usually higher than two and one-half inches, a fracture of either the tip or a greater portion of the internal malleolus, a tearing of the interosseous ligament by the wedge-shaped edge of the partially everted astragalus, and, if the force is sufficiently strong, a luxation of the lower end of the tibia, it is rather difficult for one not experienced with these fractures to realize how disastrous an end-result can be.

The poor results in the treatment of a Pott's fracture—

excluding a wrong diagnosis, for which through the notable increase in our knowledge of details obtained by the use of the roentgen ray there is at present no longer any excuse—are not poor because the proper splint is not applied, but because in all probability there has been a faulty reduction, and, if the reduction has not been faulty, it is very likely that the proper maintenance of such a reduction during the reparative process has been overlooked. Another reason for a poor result is the too early release of the foot and leg from its splinting. In this respect a Pott's fracture is unlike any other fracture, because the tibiofibular and interosseous ligaments play a very important role in preventing the widening of the mortise within which the astragalus is held.

When the mechanism producing a Pott's fracture is considered, the importance of these ligamentous structures becomes clearly apparent. In defining the mechanism of this type of fracture, we have primarily a fracture of the fibula, the pressure causing the fracture being brought to bear in the tip. The foot is turned out, causing the interosseous ligament to be put on great tension. If this ligament is sufficiently strong to withstand this tension, the break in the fibula is usually higher up than at the tip. The next phase is a fracture of the internal malleolus, to a greater or less degree. As the force continues and the weight of the leg comes on the astragalus, this tarsal bone in its partially everted position becomes wedged between the tibia and the fibula, bringing disaster to the interosseous ligament. If the force ceases here a Pott's fracture without serious complications is produced. Should the force, however, continue, a compounding of the fracture and also a forward luxation of the tibia may result.

It is obvious, from an analysis of this mechanism, that in a Pott's fracture good restoration of these ligamentous structures is absolutely necessary before walking exercises are permitted. To have this assurance it becomes imperative that this type of fracture be kept confined for a longer period in a properly adducted position than is usually allotted

to an ordinary fracture. The objective is a firm ligamentous union, and this will require more time than a bony union. The interosseous ligament harbors the essential lesion and is the most important factor as far as the final result is concerned. If repair of this structure is accurate and firm, the mortise of the ankle-joint will be very near normal and the patient will be able to walk square-footed, and the foot will be plumb with the leg.

Should, for some reason or other, the interosseous ligament remain loose or torn, a wedging of the astragalus between the tibiofibular articulation will take place, with the resultant eversion of the foot soon after weight bearing is permitted. The increased strain of these exercises upon the internal-lateral ligament will have a tendency greatly to impair the union, which is usually fibrous, between the fractured internal malleolus and the tibia. This will result in a displacement of the malleolar fragment, with more damage to the mortise. It is at this stage that the eversion of the foot becomes pronounced. When such a condition has once established itself, the eversion will be permanent, continally increasing in degree. Appliances, principally braces, are of little avail, and there remains no other way than to treat this condition on an operative basis.

A Pott's fracture, accurately diagnosed and properly treated from its incipiency, will usually result in satisfactory functional efficiency of the ankle-joint. The salient features in this type of fracture are the recognition of a possible anterior luxation of the tibia, its successful reduction when present and its maintenance during after-treatment, replacement of the external malleolus as near anatomically correct as is possible during the reduction, the proper apposition of the displaced internal malleolus with the fractured surface of the tibia, and its maintenance, so that the mortise, so essential in holding the foot plumb with the leg, may be restored; finally, the posterior and lateral splinting, preferable with plaster of Paris, the position of foot being that of flexion on the leg with an associated adduction

beyond the midanatomic line. This position is absolutely necessary to secure a perfect contacting of the normally contiguous surfaces of the tibia and fibula, thus aiding the torn interosseous ligament in regaining as much of its normal integrity as is possible, and averting a tibiofibular diastasis.

When a Pott's fracture, showing evidence of a good result, is released from its splinting at the usual time necessary for restoration, manifests an eversion deformity after six months, it is obvious that some of the structures about the ankle-joint were either not properly aligned or had not undergone sufficient repair. The ankle-joint normally is perfect in its ginglymoidal action. Any structural deviations the result of trauma will seriously impair its normal movements. The factors usually contributary to a Pott's eversion deformity are a posterior luxation of the ankle, a united and displaced fibular malleolus, and a non-union, *i. e.*, a fibrous union, of the tibial malleolus. These structural deformities cannot be recognized with any certainty merely by an inspection or a manipulation of the joint. A roentgenogram will reveal the factors responsible for any faulty relationship. Its study and correct interpretation is imperative when an operation for the correction of the deformity is contemplated.

The operation on an old Pott's fracture with a bad result is a difficult undertaking, and should never be hastily considered. It is a painstaking piece of work requiring the closest vigilance in the observance of the aseptic rituals. Perhaps the greatest difficulty encountered is the reduction of an anterior luxation of the tibia on the astragalus. An exostosis on the articular surface of the tibia may prove obstructive to a successful reduction and its maintenance and may require the use of the chisel. In extreme conditions it may become necessary to resect the anterior portion of the tibia to restore the bone to its normal relationship with the astragalus.

Fig. 1 Fig. 2

Fig. 1.—Old Pott's fracture with characteristic eversion deformity.

Fig. 2.—This shoe had been worn for three months. The light area on the sole shows where there was no contact in walking.

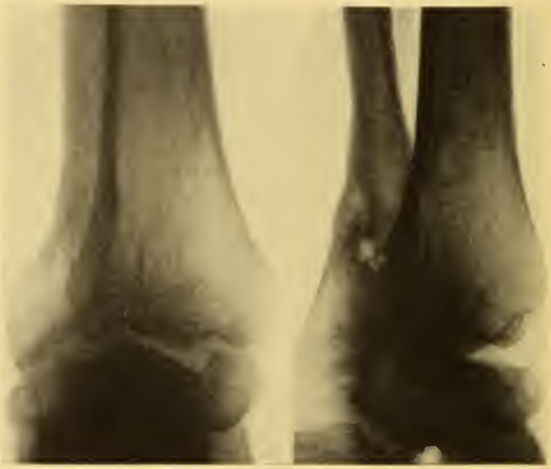

Fig. 3 Fig. 4

Fig. 3.—Old Pott's fracture. Anteroposterior roentgenogram ten months after injury. Note healed fracture of fibula about two inches above joint with lateral displacement. Note fractured internal malleolus rotated and displaced downward. There is non-union. The astragalus shows marked tilting caused by a damaged mortise. There is strong eversion of the foot. A line drawn along the middle of the tibia would strike the inner border of the astragalus, whereas normally it should fall about the middle of the bone.

Fig. 4.—Lateral roentgenogram of same case as in Fig. 3. Note rotation and downward displacement of internal malleolus, also lateral displacement with some shortening of fibular malleolus. The tibio-astragaloid articulation shows by the large gap the partial loss of its normal support.

Fig. 5

Fig. 6

Figs. 5.—Anteroposterior roentgenogram of same case eight weeks after operation showing internal malleolus held in position by nail. The fibular malleolus shows the loss of substance sustained in correcting the lateral displacement. When the bone ends were brought to an almost normal alignment there was a gap caused by loss of bone to the extent of about half an inch. This gap was bridged with a transplant. Note the filling of the gap by new bone.

Fig. 6.—Lateral roentgenogram revealing the tibio-astragaloid articulation more nearly normal than in the anteroposterior view, because the part of the picture showing where the edge of the articular surface of the astragalus had been forced like a wedge between the tibiofibular articulation is considerably obscured.

The fractured fibular malleolus may be displaced from its normal site. It must be brought into correct anatomical alignment for proper support to the astragalus. This will necessitate a refracturing of the bone and a possible interference with the tibiofibular articulation to facilitate malleolar restoration. To prevent recurrence of the deformity, the fixation of the fibular malleolus to the tibia is secured with one or two nails.

The tibial malleolus may show a malunion or no union at all, and may have been displaced downward and rotated outward by the pull of the soft parts. It will be necessary to dissect this bone-fragment out of the connective tissue mass and free it with the attached deltoid ligament from its adventitious position, that contact with the adjacent surface of the tibia may be made possible. Freshening of the broken surfaces will be necessary and their accurate apposition secured with a nail driven through the fragment and into the shaft of the tibia. These corrective measures are carried out through two lateral incisions anterior to the malleoli and sufficiently large to facilitate the work.

The operation should be performed under aseptic measures sufficiently convincing to permit wound closure without drainage. A plaster-of-Paris cast extending from the toes to the knees, exercising care that no pressure is exerted on the external popliteal nerve as it winds around the neck of the fibula, secures the foot in a flexed and adducted position. The cast is split soon after it has hardened and is allowed to remain for four weeks. A lighter cast is then substituted to remain another four weeks. Baths, massage and passive motion are now assiduously given, and after twelve weeks active weight hearing is permitted.

The operative results obtained by me in four cases of old Pott's eversion deformity, where the unfitness for work became the compelling cause for operation, were sufficiently successful in obtaining from three-fourths to four-fifths normal functional efficiency.

FRACTURES OF THE ELBOW-JOINT AND OF THE LOWER END OF THE HUMERUS

By Edgar L. Gilcreest, M.D.
San Francisco, Calif.

As structure is subservient to function, it is only natural to presume that the maximum return of usefulness in a limb would be brought about by the exact reconstruction of the deformed bone; but as perfect reduction is not infrequently impossible or inexpedient, our chief aim should always be complete restoration of function.

In the consideration of types of fractures the line of cleavage is most important. Indirect violence usually gives a spiral or torsion fracture, and there is in most cases little distortion of the limb or injury to the soft tissues. Direct violence usually produces a transverse or comminuted fracture with more deformity and soft-tissue injury.

In this paper I shall confine my remarks to fractures of the elbow-joint and the lower end of the humerus. My reason for so doing is that even today we see many poor functional results following such injuries. All surgeons of large experience know only too well, and often to their sorrow, that fractures in this region are notoriously liable to lead to suits for malpractice.

Fractures of the Lower End of the Humerus

Anatomical Consideration. Two points in the anatomy of the lower end of the humerus must always be remembered: (1)

The inner condyle is placed at a lower level than the outer when the arm is parallel to the erect trunk. By this arrangement the carrying angle is formed, a very necessary position to maintain after injury. (2) The articular surfaces of the humerus are fastened to the shaft of the bone at such an angle (130 degrees) that they point forward and downward instead of directly downward, as is generally supposed. A right-angle reduction, therefore, does not bring forward completely the lower fragment or produce a proper tilting angle to the articulation. (This explains the *rationale* of the Jones acute flexion treatment).

How many surgeons take time to visualize accurately the position of the displaced fragments, the aspect of the facets, the angles of obliquity and the rotatory changes? The roentgen ray helps us considerably in this. But, as my professor of surgery at Johns Hopkins, the late Dr. William S. Halsted, was accustomed to say, "We should be on the alert that we do not allow the roentgen ray to make us lazy;" and as Sir Robert Jones has declared, "We must beware that we do not paralyze our diagnostic faculties from pure inanition. Roentgen rays should supplement, not usurp, other means at our disposal." Further, as Jones pointed out in a masterly address delivered before the Wigan Medical Society a few years ago, "It is impossible, in quite a number of cases in young children, despite excellent pictures, to diagnose elbow fractures by means of the roentgen ray, and here our tactile education is invaluable." The reason for this is that the bones in early life are cartilaginous and therefore transparent.

Methods of Production in Adults and Children. Fractures of the humerus in the vicinity of the elbow-joint may be caused by direct or indirect violence. If an adult falls on an outstretched arm and sustains a fracture, it is usually a fracture at the base of the radius (often a Colles'). If a child, the fracture usually occurs near the elbow. Therefore, the rule can be laid down that a fracture of the elbow

in a child is almost always due to indirect violence transmitted through the hand and forearm to the elbow, with the arm hyperextended, while the same type of injury in an adult is usually due to violence applied directly to the elbow region.

If the fracture is in part intra-articular, on account of the intricate formation of the joint, it is very liable to lead to some permanent disability. The lower end of the humerus is structurally weak, due to the existence of various fossæ. If, as is frequently the case, fractures involve the hollows, the latter may become filled with callus. This callus later prevents complete flexion. Usually the fracture line is transverse, and not infrequently it is converted into a T or Y-shape by a vertical cleft running into the joint. In this way one or both condyles may be misplaced, the capitellum may be divided from the trochlea or the trochlear surface may be split. The deformity may present various conditions, and, as a rule, the lower fragment is carried backward.

Varieties of Fractures of the Lower End of the Humerus. There are actually *ten varieties* of fractures of the lower end of the humerus: (1) Supracondylar; (2) diacondylar; (3) intercondylar, T, Y, or atypical; (4) separation of the lower epiphysis; (5) external epicondyle; (6) external condyle; (7) internal epicondyle; (8) internal condyle; (9) capitellum; (10) trochlea. (Roberts and Kelly.)

1. *Supracondylar Fracture.* In this form the line of fracture is usually transverse and just above the tips of the external and internal condyles. It should be distinguished from a low fracture of the shaft and from a diacondylar fracture. In all fractures of the lower end of the humerus this type will be found in a little over one-third of the cases. This variety of fracture can be grouped into four classes: (*a*) Extension fracture; (*b*) flexion fracture; (*c*) abduction fracture; and (*d*) adduction fracture.

(*a*) In extension fractures the line of fracture runs upward

and backward from a point just above the capsule anteriorly and from the external surface inward and upward. This fracture is occasioned by a fall on the outstretched hand with the elbow in hyperextension and adduction. The lower end of the upper fragment is displaced anteriorly by its fellow fragment. The reason this fracture is seen so often in children is because the capsule is stronger than the attached bone. If this type is seen in adults, it is due to direct violence.

(*b*) Flexion fractures are very rare. The line of fracture is low posteriorly, running forward and upward. The lower end of the upper fragment is displaced posteriorly.

(*c*) In the abduction fracture the line is upward and outward.

(*d*) In the adduction fracture the line is just the reverse, that is, upward and inward.

2. *Diacondylar Fracture.* Like the supracondylar type, this fracture is usually transverse, but is lower, occurring just above the line of the epiphysis, and is partially intra-articular. The line of break is similar to that of the extension variety of the supracondylar type.

3. *Intercondylar, T, Y,* or *Atypical Fracture.* This fracture usually occurs in adults and is generally due to direct violence, and is frequently compound. The characteristic feature in this fracture is the separation of the condyles from the shaft and from each other. Often there is great displacement of the fragments and considerable traumatism to the surrounding soft tissues.

4. *Separation of the Lower Epiphysis* is undoubtedly very infrequent. It is observed in childhood up to the fourteenth to the eighteenth year, but usually before the age of three years. The line of separation may be through the epiphyseal cartilage or there may be attached to the epiphyseal cartilage portions of the lower end of the diaphysis. Cohn considers this really a fracture through the cartilage—a condition which might better be called a supracondylar fracture.

5. *Fracture of the External Epicondyle* should be mentioned, but is rarely seen. It results from direct violence, the impact being received by the external surface of the lower end of the humerus or from indirect violence, as when a tear fracture results from hyperadduction of the elbow. With this fracture posterior dislocation of the radius and ulna may take place.

6. *Fracture of the External Condyle.* This type occurs in about 17 per cent of the fractures of the lower end of the humerus and is most frequently seen in children. The line of break often takes a course from the joint obliquely upward and outward, and the detached fragment may consist of a part of the trochlea, the capitellum and the epicondyle. It may result from a fall directly upon the external condyle; from a fall upon the hyperflexed elbow, the external condyle receiving the brunt of the impact; by hyperadduction of the elbow (tear fracture); from a fall upon the hand with the arm in full extension, the impact being transmitted through the radius to the capitellum.

7. *Fracture of the Internal Epicondyle.* In many instances the detached epicondyle is really a separation of the epiphysis. The fusion of the epiphysis with the diaphysis of the humerus occurs about the eighteenth year. Direct violence, such as a fall upon the arm in abduction, may produce the fracture or separation. However, the usual cause is hyperabdunction of the elbow while in a position of full extension.

8. *Fracture of the Internal Condyle* is unusually rare. The line runs from the inner border above the internal epicondyle downward and outward to the trochlear surface. The ulna is attached to the fragment and both are held in fair position by the radius. If the fragment is displaced upward the carrying angle is diminished.

9 and 10. *Fracture of the Capitellum and Trochlea.* Linden finds that the literature reveals only 17 cases of fracture of the distal articular processes of the humerus; these include fractures of either the capitellum or trochlea, or both. The lesion is a splitting of the articular surface of the bone by

a fracture through the cancellous portion, the fragment consisting only of the articular cartilage and a thin strip of underlying bone.

Treatment

For the treatment of fractures in the vicinity of the elbow-joint, with the exception of fracture of the olecranon process, the fully flexed position offers the best results. Often a splint is unnecessary, the forearm being strapped to the upper arm and fixed to the chest with a bandage.

The advantages of the flexed elbow position are:

1. It gives the most complete anatomical reposition of fragments and the best fixation.

2. It favors the retention of the more important flexion function of the joint.

3. It coöperates with gravity in the subsequent restoration of function.

In correcting the initial deformity the following procedures should be carried out:

1. Strong traction is exerted on the forearm with the elbow fully extended and supinated.

2. At the same time the joint is manipulated, the displacement being corrected as far as possible; usually the upper fragment will be found to be displaced forward and the lower backward.

3. While maintaining No. 1 and No. 2, the elbow is slowly but firmly flexed to an acute angle and so fixed with the forearm supinated.

As to how long this position of acute flexion should be maintained, of course, will depend somewhat on the case, but usually after about two weeks the forearm can be lowered a few degrees every four or five days. This should be continued until the arm can be fully extended. However, during this process of mobilization, should the elbow stiffen so that the patient cannot obtain the initial degree of flexion, all movement should cease and the arm should again be put in the completely flexed position and so main-

tained for another week. During this time gentle massage can do nothing but good.

Passive movement should begin in the fourth week and should consist of only one movement in each direction (pronation, supination, flexion and partial extension), and then the arm should be replaced in a sling. As this movement is gently and slowly carried out by the hand, the fracture is protected from strain by the surgeon's other hand. If this passive movement produces much reaction or elicits much pain, it should not be repeated for several days. The joint should be allowed time to recover from the damage. A rebellious reaction following passive movement indicates Nature's plea for more rest, and no time is saved by trying to hurry the mobilization.

Cohn has pointed out that attention must be directed toward developing the external rotators of the humerus in supracondylar fractures, otherwise patients will continue to carry the arm in the position of internal rotation, which will give a *cubitus varus* of muscular rather than bony origin. In these fractures the position of hyperflexion puts the biceps muscle on the stretch, so that it acts as a natural splint.

In fractures of the internal condyle both pronation and hyperflexion of the forearm are necessary, since muscles are more relaxed in this position and the brachioradialis and supinator brevis tend to diminish the carrying angle.

In fractures of the external condyle, pronation would cause the pronator teres to pull the fragment away from the humerus.

Fractures of the Upper End of the Radius and the Ulna

In considering fractures of the elbow-joint besides those of the lower end of the humerus, there may be one (1) of the olecranon process, (2) of the coronoid process or (3) of the head and neck of the radius.

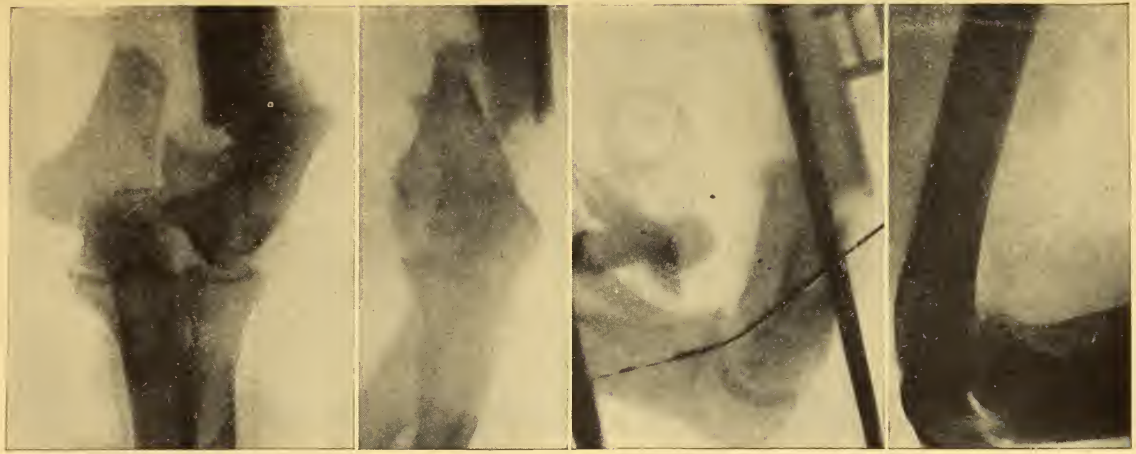

Fig. 1 Fig. 2 Fig. 5 Fig. 6

Fig. 1.—Case I. Anteroposterior view of right elbow. Compound intercondylar T fracture involving joint. Note that the lower end of the humerus is fractured and driven down between the fractured and separated condyles. The proximal end sustained a subcoracoid dislocation.

Fig. 2.—Case I. Lateral view of right elbow. Note that the two lower fragments are projecting anteriorly; usually these fragments project posteriorly.

Fig. 5.—Case I. Note how traction of pneumatic pad is not only pulling down but pushing back the lower fragment.

Fig. 6.—Case I. Lateral view of left elbow. Note compound fracture of olecranon process into joint.

Fig. 3 Fig. 4 Fig. 7

Fig. 3.—Case I. On account of the dislocation of the shoulder this arm was put in abduction for two weeks in a Cleary right angle aëroplane splint with traction on forearm.

Fig. 4.—Case I. Position used at the end of two weeks. The flexion of the forearm was increased daily until an acute angle was obtained. Traction is exerted on a pneumatic pad in elbow.

Fig. 7.—Case I. Note sand bags in hand with hot applications on elbow-joint. The method of obtaining extension after joint had been held in acute angle for some time.

Fig. 8 Fig. 9 Fig. 10

Fig. 8.—Case I. Anteroposterior view of right elbow six months after injury. Note how well the widely separated condyles have attached themselves to the humerus.

Fig. 9.—Case I. Lateral view of right elbow six months after injury. Note the perfect anatomical alignment of the two condyles with the main shaft.

Fig. 10.—Case I. Lateral view of left elbow six months after injury. Note that while the *x*-ray does not reveal perfect bony union, the function result is perfect.

Fig. 11 Fig. 12 Fig. 13 Fig. 14

Fig. 11.—Case I. Note that flexion of left elbow is perfect and only slight limitation of right elbow.

Fig. 12.—Case I. Note extension of both elbows.

Fig. 13.—Case I. Note how patient can use the right elbow for eating and shaving.

Fig. 14.—Case I. Note complete reëstablishment of carrying angle.

Fig. 15 Fig. 16

Fig. 15.—Case II. Anteroposterior view of severely comminuted fracture of lower end of left humerus. Note spicules of bone fragments projecting into the soft tissues.

Fig. 16.—Case II. Lateral view. Note anteroposterior separation of lower fragment with the upper shaft in between. The humerus is converted into four large and several smaller fragments.

Fig. 17.—Case II. Method of traction on humerus with flexion on elbow. On account of a large wound of the axilla an ambulatory splint was not used.

Fig. 18 Fig. 21

Fig. 18.—Case II. Abduction of shoulder under heat. Note sand bag on top of large hot compresses overcoming contracture in axillary region.

Fig. 21.—Case II. Exercises on stall-bars for stretching scar tissue in old axillary wound.

Fig. 19 Fig. 20

Fig. 19.—Case II. Anteroposterior view six months after injury. Note the alignment and attachment of fragments with the main shaft. Note that the sharp spicules of bone as shown in Fig. 15 have been completely absorbed or have united with the main shaft.

Fig. 20.—Case II. Lateral view six months after injury. Note how the anteroposterior separation has been entirely corrected and the alignment is satisfactory.

Fig. 22 Fig. 23

Fig. 22.—Case II. Flexion six months after injury.
Fig. 23.—Case II. Extension six months after injury.

Fig. 24

Fig. 25

Fig. 26

Fig. 27

Fig. 24.—Case III. Note fracture of external condyle with dislocation of forearm.

Fig. 25.—Case III. Six months after injury.

Fig. 26.—Case III. Note perfect extension.

Fig. 27.—Case III. Note perfect flexion.

Fig. 28 Fig. 29

Fig. 28.—Case IV. Oblique supracondylar fracture. Note that the lower fragment is displaced posteriorly, which is most often found and is the reverse of condition shown in Fig. 2, Case I.

Fig. 29.—Case IV. Lateral view immediately after reduction. Note complete reposition of fragments and how the position of acute flexion maintains them.

1. *Fracture of the Olecranon Process* involves the elbow-joint and occurs usually at the base or weakest part of the process. It is due to direct injury and is frequent in adult life.

Treatment. Extension of the elbow for two or three weeks, then begin active movements. At the end of four weeks the elbow can be brought to a right angle. Fibrous union with a gap is not frequent enough to warrant an immediate operation, and union is nearly always satisfactory.

Whitchurch Howell reports a case in the *Proceedings of the Royal Society of Medicine* of a fracture of the olecranon process, fracture of the coronoid process and a separation of the epiphysis, which he treated in acute flexion in spite of the fracture of the olecranon.

2. *Fracture of the Coronoid Process* may be due to a backward dislocation of the elbow-joint. Its danger is that an obstructive spur may be felt in the joint or that a traumatic myositis ossificans may be produced.

Treatment is by complete flexion.

3. *Fracture of the Head or the Neck of the Radius* is not rare. There is no room in this part of the elbow-joint for even the slightest displacement or for excess of callus, so that either one may give considerable pain and mechanical disability in the flexion of the elbow and the rotation of the forearm. The fragment is usually displaced outward and forward and may be mistaken for a small piece of the external condyle. The elbow can be almost fully extended and flexed, but supination and pronation are limited.

Treatment. Full flexion for several weeks. As it is important to limit any excess callus formation, early movement is contraindicated. If there is actual obstruction to supination the fractured piece should be immediately excised.

Treatment of Compound Fracture of Elbow-joint. In fractures of the elbow-joint where sepsis is present, it is often useful to put the supinated arm up in full extension and fixation in a Thomas arm-splint until the acute sepsis has been controlled or the fracture has begun to show signs

of union. Nearly always even finely comminuted fractures, in which we know a large part of the fragments are absolutely detached, if not infected, unite very rapidly, forming a large callus. The arm should then be gradually flexed, maintaining the supination. It is unwise to leave the arm extended more than one month for fear of bony ankylosis in this awkward position.

May I be pardoned for saying just a word as to the *time for reduction of fractures?* As pointed out by Blake, many still think that a fracture can be reduced at any time within the first ten or twelve days. It is an erroneous and pernicious idea to wait until the swelling subsides. Early reductions often prevent much swelling. Repair does not go on indefinitely; sooner or later it ceases; therefore, it must be conserved and not wasted.

Complications. The possiblity of such complications as

1. Volkmann's contracture,
2. Traumatic myositis ossificans,
3. Ulnar nerve injury or median nerve injury,
4. Permanent restriction of movement from excessive callus formation in the fossæ should make the surgeon treating fractures in the vicinity of the elbow-joint always on the alert to prevent them.

The possibility of Volkmann's ischemic paralysis should always be kept in mind, particularly in children. It can be largely prevented by (1) leaving no pad in the elbow, or, if one is necessary, a pneumatic pad, as shown in the photograph; (2) by having no constricting band or bandage about the joint; (3) by seeing that the angle of flexion is not too extreme.

Indications for Operation. Besides (1) removal of the head of the radius, as mentioned above, Stone has called attention to one group of cases requiring open reduction, namely, (2) those in which the epiphysis has been detached and has turned turtle, for replacement by manipulation in such cases is usually impossible; (3) fractured fragments of the capitellum and trochlea should be excised;

(4) coexisting nerve injury should be a clear indication for operation. If operation is indicated, it should be done at the earliest possible moment. One should try to be clear in his mind and decisive in his action whether or not he will treat a case by closed or open reduction. Rixford, in his excellent article, "On the Mechanics of Production and Treatment of Spiral Fractures," has emphasized that "the open operation should not be neglected to the position of last resort."

Among the French and Belgians, Lambotte is an uncompromising advocate of the open operation, and among the Germans, Bardenheuer takes an extremely conservative position, while Robert Jones, of England, assumes a position between the two. I believe that too many American surgeons are not sufficiently trained in the methods of traction, or have not enough patience in the treatment by closed methods, and therefore resort to open operation too frequently. This is due to the fact that fractures in our medical schools are treated often under the head of minor surgery, and are often below the attention of the professor of surgery, who confines himself largely to the more dramatic anatomical area, the abdomen.

We should never lose sight of the fact that some of the ugliest and anatomically poorest appearing elbows may possess remarkable movement, while many elegantly shaped joints may be practically devoid of it. This should be clearly explained to the patient by the surgeon to avoid criticism later. It should also make us think twice before we operate and introduce screws, silver wire, bands and Lane plates.

The ultimate attainable aim in the treatment of fractures of the elbow-joint must be the formation of a normal joint. If, when the fracture is healed, the range of motion is sufficient to bring the hand to the mouth in flexion and to place it in the trousers pocket in extension, the result is considered satisfactory.

In conclusion, by way of emphasis, I wish to state that

only recently I was called in consultation to see a young woman who had sustained, a year or two previously, a comminuted fracture of the lower third of the humerus, not as severe as shown on the accompanying photograph. No attempt was made to reduce the fragments by traction and flexion. An open operation was performed and a band applied. This became loose afterward and a second operation was performed and a Lane plate inserted. A third operation followed, and this time silver wire was the metal of choice. Sepsis occurred and the wound did not heal for months. When I saw the case the greater part of the lower third of the humerus had been destroyed and the girl's chance of having a normal arm was gone forever. Bone grafting offered the only chance of securing for her an arm at all. This is just one of many cases such as all of you have seen. But should not such cases make us stop and think what we can do to prevent as far as possible the ruthless open operation on fractures? We hear a great deal among the internists about preventive medicine; should we not hear more among surgeons about preventive surgery, especially in the treatment of fractures?

Case. I. *Compound Intercondylar T-Fracture Involving Joint.* This fracture is exceedingly interesting. It occurred in a man, aged fifty-eight years, weighing 220 pounds, who was hurled fifteen feet from a revolving wheel. He sustained seven fractures, three of them compound, and two dislocations. The right arm shown here evidently received more than its share of the impact, as he sustained a transverse fracture of the lower third of the humerus with a splitting fracture extending down into the joint, converting it into a complete compound intercondylar T-fracture and separating the condyles widely. The head of the humerus on the same side was dislocated. Where the condyles are so widely rent asunder we can be absolutely certain the two lateral ligaments have been extensively ruptured. In

this case the shaft was, as it were, driven down between the separated condyles.

The problem which presented itself in this right arm alone was the reduction and treatment of the dislocated shoulder, the reduction and treatment of the compound intercondylar T-fracture of the elbow-joint and the prevention of sepsis to the joint. The arm was put in a right-angle abduction aëroplane splint with traction on the forearm for two weeks. During this time, as you will see from the photograph, the forearm was in pronation. The wounds were treated with dichloramine-T. The arm was then taken down and put in a Jones right-angle splint. The problem then was to bring about four things, namely: (1) To still further correct the shortening; (2) to push the upper fragment forward and the lower fragment backward; (3) to obtain as quickly and as completely as possible the angle of acute flexion; (4) to secure complete supination of the forearm. The accompanying photographs tell the story of how this was accomplished.

This man made practically a complete recovery and was back at work in less than a year from the date of injury. The only residue which remained of his multiple fractures was a slight limitation of flexion and extension of his right elbow. This, as you see by the photographs, was so slight that he can easily flex his arm to eat or shave, and readily put his hand in his trousers pocket.

Case II. *Severely Comminuted Fracture of the Lower Third of the Humerus.* This occurred in a man, aged thirty years, and was due to a very heavy log rolling over his arm. The humerus, as you will see, was broken into six fragments, with several small spicules projecting out into the muscles. This fracture was complicated by a large infected wound of the axilla of the same side. The accompanying photographs show that this arm was treated by flexion and traction

with practically a 100 per cent recovery of all movements. The mistake is often made in this type of fracture of applying metal bands or silver wire. Traction makes the biceps and triceps muscles natural splints which mold these fragments together. The small spicules of bone in the muscles should cause us no alarm, as they are later absorbed.

Case III. *Fracture of the External Condyle with Dislocation of the Forearm.* This occurred in a child of two years who was seen immediately after injury. Supination, traction and flexion of the forearm gave a complete reduction with a perfect ultimate recovery, as shown by the accompanying photograph.

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FRACTURED SPINE: CONSIDERATION OF THE PRACTICAL CARE AND TREATMENT[1]

By Walter C. G. Kirchner, M.D.
St. Louis, Mo.

The subject of fracture of the spine has received much consideration from the standpoint of diagnosis and surgical treatment, in which instance the lesion itself has attracted the greatest amount of attention; while, on the other hand, there has been not enough interest shown in matters relating to the general care and welfare of the patient as a whole. No matter how well the operative or general surgical treatment may be directed, unless the treatment of the entire patient be taken into consideration the results are not likely to be favorable, and it is a discussion of this latter phase of the subject to which I wish particularly to call attention. We shall be interested chiefly in the graver lesions in which the spinal cord is involved and in which there is a definite paralysis.

During the past twenty years, in general hospital service as well as in the military service, I have had occasion to treat a considerable number of cases of fracture of the vertebræ, and all degrees and types have been encountered; but for our purpose I shall present only a single case which offers a number of interesting points for discussion. A brief synopsis of the history of this case is as follows:

Case History.—Mr. J. J. L., aged fifty-one years, a mechanic, on August 4, 1919, while in an excavation and while straddling a pipe, was crushed by the wall which caved in

and buried him completely. He was rushed to a hospital, where it was found that he was in great shock, had suffered a fracture of the vertebræ, and that the lower limbs were completely paralyzed. The roentgen examination disclosed a pronounced dislocation of the third and fourth vertebræ and fracture of the transverse processes of these vertebræ. He was placed on a Bradford frame and Buck's extension was applied to both lower extremities. This form of extension was continued for three weeks, when a second roentgen examination was made and it was found that the deformity was somewhat less. On account of the irritation to the skin caused by the adhesive strips the extension had to be discontinued and he was placed in a fracture-bed. On October 15, 1919, I was called into consultation and noted the following condition:

The patient was weak and emaciated and the ribs were prominent; the heart action was feeble and he was easily exhausted; he could not move the lower extremities. The knee-jerk and plantar reflexes were absent. The cremasteric reflex was present and was more marked on the right than on the left side. There was no anal reflex. Sensation was present on the anterior aspect of the right lower extremity and extended as far as the great toe and inner side of the right foot. There was some sensation on the anterior aspect of the left thigh, but not below the left knee. There was incontinence of urine and feces. In the sacral region there was a large bed-sore. On November 11, 1919, when I was given complete charge of the case, the neurological findings were about the same, and very slight muscle movement was detected in the right thigh. Foot-drop was pronounced. The heels of both feet were black. The bed-sore on the back was five inches in diameter and the muscular coat of the rectum and the bare sacrum were exposed. The margins of the bed-sore were undermined for a considerable distance. There was edema of the penis and of both lower extremities. He was able to be propped up in bed, but was still very weak.

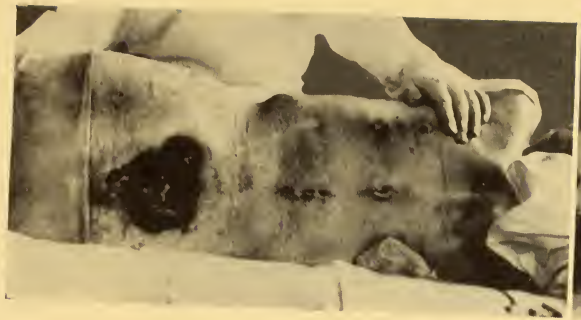

Fig. 1

Fig. 2

Fig. 1.—Decubitus following fracture of the spine. The large bed-sore exposes the sacrum and the posterior wall of the rectum. The wound margins are undermined for a considerable distance by sloughing necrotic tissue. (Service Unit 1, Washington University, City Hospital.)

Fig. 2.—Strong, well-padded and comfortable plaster shell applied to the back and held in position by a sand bag. The shell is cut away at the lower part to relieve pressure over the bed-sore and to permit of easy dressing of the wound.

Fig. 3

Fig. 4

Fig. 3.—Method of supporting and treating bed-sore by means of strapping, lattice fashion, with adhesive strips. The traction assists in the healing process and greatly diminishes the size of the bed-sore by approximating the true skin margins.

Fig. 4.—Effect of treatment on a bed-sore which was over five inches in diameter. Wound almost entirely closed in by true skin. A deep, perforating trophic ulcer over the left tuberosity is indicated by a rubber tube for treatment with Dakin's solution.

Fig. 5

Fig. 6

Fig. 5.—Frame-work (Balkan frame) of home construction, which has been erected over bed to facilitate the handling and treatment of patient.

Fig. 6.—Method of supporting lower extremity by means of soft pads and pillows to prevent bed-sores. The heel should be kept free to avoid pressure sores. The atrophic muscles as well as other parts of the body are massaged daily and all joints are manipulated.

Fig. 7

Fig. 8

Fig. 7.—A suitable fracture-bed permitting of easy elevation of trunk to sitting position and of satisfactory use of bed-pan by lowering of middle section. The trapeze enables the patient to lift himself, thereby materially assisting the nurse in the care of the patient. An elastic supporter may be used to correct foot-drop.

Fig. 8.—The frame enables various types of apparatus and treatments to be put to use. The sling for the leg permits of easy adduction and abduction of the lower extremity. The foot is always supported so as to correct foot-drop.

Fig. 9

Fig. 10

Fig. 9.—Patient in shell elevated to sitting position, thus relieving pressure on the back. The position improves the circulation and the general health of the patient. He is also thus enabled to feed himself.

Fig. 10.—In the recumbent position the seat of the swing is placed under the buttocks. When the patient is raised to the sitting position the ropes and pulleys of the swing are adjusted. The back-rest having been lowered, the patient in the swing is easily elevated; the bed is removed to one side and in its stead is placed a roller-chair into which the patient is lowered. The bed-ridden patient is thus enabled to get about.

Fig. 11 Fig. 12

Fig. 11.—Locomotion is enabled by means of the "perambulator," which when placed a short distance in front of the patient enables him to drag himself forward or to take steps as in walking. The patient's back is supported by a corset which the writer had specially designed.

Fig. 12.—The patient is also taught how to use crutches and in the beginning the tripod method of locomotion is most useful. The upright position permits the bed-sores to heal more rapidly. Weight-bearing strengthens the knees and also seems to reëstablish the sense of equilibrium.

Fig. 13

Fig. 14

Fig. 13 (Case I).—Very pronounced dislocation between the third and fourth lumbar vertebræ associated with fracture, causing immediate complete paraplegia. With appropriate treatment there was a gradual and also a marked restoration of function.

Fig. 14 (Case I).—Shows improvement in alignment of vertebræ after application of traction for three weeks. (The author is indebted to Dr. M. L. Klinefelter for the roentgenograms, Figs. 13 and 14.)

Feces were impacted in the rectum and there was a pronounced cystitis. There was no control of the bladder or rectum.

Splints were applied to both feet and legs, to correct the foot-drop and to relieve pressure on the heels. The bed-sore was strapped with strips of adhesive plaster to aid in drawing together the margins. A strong and firm plaster shell extending from the shoulders to the hips was applied to give support to the back and to relieve pressure on the bed-sore. The application of the cast occasioned a chill and tremors, though the temperature and pulse rate remained normal. On November 25, 1919, with casts and shell applied, he was removed to his home and placed in a fracture-bed. The shell furnished a useful means of transportation. At his home the bed-sores received constant attention. The cystitis was treated and the bowels were kept properly regulated. A Balkan frame was installed early in December and the lower extremities were swung, hammock-like, in Hodgen splints, thus assisting in voluntary muscular movements. The patient received massage daily. By December 29, slight adduction and abduction of the right thigh and flexion at the right knee were noticed, and also slight adduction of the left thigh. The edema of the penis, scrotum and hips had been reduced. At times there were shooting pains in the left limb. The patient grew fond of his shell and gained in general health and strength. By February 1, 1920, a deep trophic ulcer had developed in the left buttock over the tuberosity, and all the other wounds showed improvement. On February 11 the patient had a chill and the temperature was elevated to 102.6° F. There was a slight mucopurulent discharge from the rectum. On the following day, the temperature was reduced, but there was a reddened area about the left hip resembling erysipelas. The area of redness migrated downward along the thigh and disappeared in three or four days.

On April 25, the patient again experienced severe shooting

pains in both lower limbs, extending into the feet. The left foot was more painful than the right and a sedative was required to give relief. The next morning there was edema and redness about the left hip. The inflammation again descended, this time as far as the foot. The right thigh was also reddened. The temperature was 100° F., and the pulse rate 100.

On May 6, the patient was taken to a hospital for a roentgen examination and returned to his home, where, on the next day, a neurological examination, made by Dr. W. W. Graves, showed the following: "The general nutrition is fair, though there is still marked general emaciation. There is marked wasting of the muscle of the lower extremity on the right, and as far as can be determined by palpation there is no muscle tissue remaining in the right leg. There is fairly good quadriceps function. There is slight adduction and inward and outward rotation at the hip. There is also slight function retained in the inner hamstrung muscles. There is marked tendency to foot-drop and supination of foot on the right, also on the left. No muscle tissue can be palpated about the left leg. The quadriceps group is wholly atrophied; abduction and extension of hip are *nil.* adduction and inward rotation fair. It is noted that the urinal is kept in constant position. The left knee-jerk is absent; the right knee-jerk is present. Sensation on the left to pin-pricks and apparently in all other qualities of sensation is wholly abolished below the knee; retained about the anterior and outer aspects of the left thigh and to the knee joint on the outer surface and to within four inches of the knee joint on the under side. Sensation is preserved on the outer and upper third of the right thigh; about the right lower extremity sensation was profoundly disturbed about the outer surface of the right leg and the greater portion of the foot, otherwise sensation is fair about this extremity. There is complete loss of sensation in the gluteal region in a zone corresponding to the distribution of the third, fourth

and fifth sacral roots. There is a scar over each heel from decubitus."

The roentgenologic report of Dr. E. H. Kessler was as follows: "The third and fourth lumbar vertebræ are dislocated and there is a fracture of the transverse process and of the inferior articular process of the third vertebra. The fourth lumbar vertebra is fractured through the transverse process and the superior articular process is also fractured. The dislocation is lateral and anteroposterior."

A small rectal abscess developed, which was operated on June 23, 1920. On July 8, there was slight voluntary flexion of the left knee, though flexion of the right knee was quite complete and the entire right limb in extension can be raised and flexed at the hip.

On August 21, there were severe shooting pains in both lower limbs, the temperature was 101°, and, as on a previous occasion, redness of the skin developed about the hips and migrated toward the feet. The reddened area is painful and is hotter than the surrounding skin. This manifestation of pain, elevation of temperature and reddened skin recurred on October 22, 1920, and again on March 21, 1921.

Since July 23, 1921, the patient has slept at night without a cast or shell. During the day he was placed in a wheel-chair. Since November 14, by employing the abdominal muscles, he was able to expel urine, and regular catheterization was discontinued. On December 11, he was able, with assistance, to get out of bed and into the roller-chair without the use of his swing. He has daily taken exercises to develop the atrophied muscles and to regain locomotion. The rectal function has shown improvement and he now has moderate control. The bladder function is still inadequate, though during the day he manages to hold the urine about two hours. During the night he is obliged to provide himself with a urinal. Since the patient has been able to be up and about the bed-sores have healed, the shooting pains are less severe and his general condition has markedly improved.

Cases of fractured vertebra must be considered with regard to the treatment of the immediate condition and also with regard to the secondary and remote complications following injury to the spine and cord. The primary handling of the case is concerned with the treatment of shock; the reduction of fracture or dislocation, whether by manipulation or operation, for the relief of pressure on the cord; the treatment of the bladder and the rectum when paralyzed and the treatment of respiratory and cardiac complications. In certain cases it is difficult to determine whether or not resort should be had to immediate operation in order to relieve symptoms of compression of the cord. The remote care of the patient demands appropriate treatment directed toward the cure of bed-sores, trophic disturbances involving the different tissues, edemas, abscesses, cystitis, neuritis and other nerve lesions, atrophy of muscles and the prevention of infection and sepsis.

Patients suffering with fracture of the vertebræ and injury to the cord with paralysis die as a result of shock or paralysis of vital functions, or more remotely as a result of sepsis and a state of inanition. Bearing this in mind, special attention must be paid to all objective as well as all subjective symptoms. The incontinence of urine and feces, decubitus, the results of trophic changes, pulmonary and cardiac symptoms, all demand very careful consideration and attention. As a factor in prognosis and treatment, due regard should be had for all subjective symptoms. The patient's mental condition and habits should be studied so that a hopeful attitude toward recovery may be encouraged. The character of the so-called root pains and the various nervous manifestations and sensations are often guides as to the progress of the case. The root pains may be so severe that sedatives and even operation may be required to give relief.

The lack of proper bladder function is a very distressing complication, If possible, cystitis is to be avoided and this condition is only too often invited by catheterization, which

a distended bladder seems to call for. Unless the pain and bladder distention are too great, catheterization should be avoided for fear of infecting the bladder. When catheterization must be resorted to, the bladder should be irrigated with sterile boric acid solution, and argyrol or other antiseptic solution should be instilled to control infection.

The incontinence of feces can be properly controlled. The stools should be kept soft, and this can be accomplished by the proper administration of liquid petrolatum or similar preparation. At times a cathartic may be required. A cleansing enema given daily will keep the patient in a clean and satisfactory condition.

The bed-sores are the result of trophic changes and long-continued pressure on the skin. In handling bed-sores, pressure areas must be avoided. Alcohol, bismuth preparations, etc., which harden and toughen the skin, are better than oils and ointments which soften the skin. I have found Dakin's solution and Hyclorite solutions, of appropriate strength, very efficient in cleaning up sloughing bed-sores. It may be necessary to employ tubes, so that the wound may be frequently treated with the solutions. Large bed-sores should be strapped, lattice-fashion, with adhesive strips, so as to approximate the wound margins and thus to relieve tension and the tendency to enlarging of the wound. Scarlet-red ointment is useful in stimulating epithelial growth. Balsam of Peru in castor oil and other ointments are useful at times. Superabundant granulation may be controlled by the use of tincture of iodine. The healing of wounds is a special study, and each wound and often the different parts of the same wound may require different treatment. It is often necessary to vary the procedure in the treatment of a wound according to its special demands and requirements. The importance of this latter fact is often not appreciated.

The therapeutic measures must be applied as the special indications require. Massage of the entire body, and especially of the affected extremities, is necessary to keep up the

tone of the muscles and the joints supple. Massage of the scars of healed ulcers is useful in making the skin mobile, pliable and more resistant. The beneficial effects of massage cannot be overestimated.

A patient suffering a paralysis as a result of fracture of the vertebræ is so helpless that mechanical means is required to furnish aid and comfort. Appropriate splints or supports should be adjusted to the lower extremities to prevent decubitus and foot-drop. The plaster shell is an efficient means of making the patient comfortable, preventing or treating bed-sores and of enabling easy transportation and handling of the patient while in bed. A properly applied shell also helps to correct deformity of the spine. When the shell may be dispensed with, a removable body cast takes its place. As the condition improves, the cast is replaced by a plaster jacket or corset of special design. A fracture bed is almost essential in the proper handling of the patient. A properly constructed framework over the bed (Balkan frame) is so desirable that it should form a part of the equipment in treating the patient. The frame permits the patient to be supported, and by means of pulleys, ropes, slings, splints, swings, etc., various movements of the body and limbs are made possible. The frame enables the patient to take the first steps toward getting out of bed, and thus hastens convalescence.

The nursing of the patient with a fracture of the back is exceedingly important. There are many things regarding the proper care of the patient which are unusual and disagreeable, and there is a great tendency to shirk responsibility. Often the cases are considered hopeless and the nurses and attendants show a lack of proper interest and perform their duties in a mechanical and perfunctory manner. The inability of the patient to help himself and the difficulty of handling the patient make the case a trying one. It is the incontinence of urine and feces that are the source of greatest annoyance, and in proportion to the mastery of these complications

depends the success in the treatment of the case. The nurse who is successful in these cases knows the value of extreme cleanliness and care. The hair about the genitalia should be shaved, so that the parts may be kept surgically clean. The urinal should be of the proper type, so that leakage and soiling are avoided. The bowels must be kept properly regulated, and cleansing enemas should be given daily. The bed-clothing must be kept dry and clean. I have been able to train housewives for this type of nursing who have succeeded better than the trained nurse, because of their extreme interest and attention to detail. The nourishment, hygienic surroundings, ventilation and attention to the mechanical adjustments are important factors in the treatment. Extreme patience and care are required, and when these virtues are made a part of the intelligent treatment, favorable results may eventually be expected.

In concluding, I wish to make a plea for a more hopeful attitude in regard to the prognosis in cases of fracture of the vertebræ. Intelligent nursing, cleanliness and the proper care of the bladder and bowels are important factors in the treatment. The plaster shell, the Balkan frame and a suitable fracture-bed are also important adjuncts. In the treatment of bed-sores, the surgeon must master the principles of wound-healing. Attention must be paid to the patient's psychic condition, and occupational therapy in this type of cases finds an important place. The active and paralyzed muscles must be studied and the surgeon must select exercises and movements, so that inactive muscles may be developed and that proper re-education of muscles may be made possible. With attention to these details, the surgeon may sometimes be rewarded by a favorable outcome in a type of cases of fractured spine that was considered hopeless.

TYPHOIDAL OSTEOMYELITIS

By Nathan Winslow, M.D.
Baltimore, Md.

Notwithstanding that 0.82 per cent of all typhoid cases develop metastatic bone disease and 0.43 per cent of all osteomyelitic lesions are typhoidal (Murphy), but scant consideration has been given the subject by American writers. As long ago as 1835, Maisonneuve recognized osteomyelitis as a complication of typhoid. In 1876, Keen, from an analysis of 37 cases, decided that a definitie connection existed between the attack of typhoid and the subsequent bone affection; but it remained for Ebermaier in 1889 to isolate in pure culture the typhoid bacillus and thereby establish definitely the dependence of the bone manifestations upon the initial disease. While the bone distempers consecutive to typhoid fever are most commonly due to the typhoid bacillus, the abscess may be the seat of a mixed infection, or it may contain the pus cocci, or it may be sterile. Of the 51 cases of inflammatory bone disease presumably of typhoidal origin collected by Keen in a second paper, published in 1898, 13 grew the ordinary pyogenic cocci and 38 the typhoid bacillus alone or in combination with other bacteria. Ebermaier was the first to call attention to the typhoid bacillus soon leaving the blood-stream and seeking refuge in the bone-marrow. From the marrow of a piece of rib secured at the autopsy upon a man who had died of hemorrhage, he grew in culture media a

few colonies of this microbe. A striking peculiarity of this habit, however, is the lack of development of manifest focal disturbances. Unless it becomes activated, the host is oblivious of being a carrier. Why these bacilli after varying periods of latency are suddenly aroused into pernicious activity, no one has as yet satisfactorily explained. Keen believes muscle strain is a sufficient provocation to arouse their malevolent tendencies. Bondet attributes it to the slight traumata incurred by the use of the ice baths, and Fogh, among others, to a blow. Le Filliatre has seen it follow fatigue. Mouisset mentions it as having occurred at the site of an old fracture and Finlayson in the scar of a tubercular lesion. While typhoidal osteomyelitis may occur during the fever or in unusual instances after the lapse of years, the period of defervescence is the commonest time. Bunts reports the recovery of a pure culture of typhoid from a tibial abscess, seventeen years after the appearance of the attack. Fogh mentions their existence for twenty-three years in the femur and Tubby and Hicks for thirteen years in the ulna; Gore for eleven years in the frontal and a number of observers for periods from a year upward. More mystifying, however, are those cases with open sinuses for months and years which yield a pure culture of the typhoid bacillus. According to the modern concept of bacteriology, when drainage exists the original typhoid infection should be crowded out by the pyogenic cocci; yet Sultan reports a case in which a pure culture of the Bacillus typhosus was obtained from an open sinus of six years' standing, and Parsons a case from the pus of which at operation the typhoid bacillus alone was grown, but from the resulting sinus, six weeks later, the Bacillus typhoideus associated with the Staphylococcus pyogenes aureus. As long as a person shelters a single bacillus, he is a menace not only to himself but also to the community. The supposition is that from time to time bacterial emboli are swept into the blood-stream to find lodgment at other points or

to be filtered out by the kidney and passed in the urine. To this behavior is attributed the successive metastatic bone explosions. Bigelow has reported an instance of a typhoidal sinus acting as a source of infection to others. Fruit handled by the patient served as the intermediate agent. The intensity of the primary attack does not have any particular influence on the severity of the bone lesion. A mild case may be followed by a very acute osteomyelitis, and *vice versa*.

The disease is scarcely ever acute, almost always chronic. Although only one bone is usually involved, it is not uncommon for more than one to be attacked either simultaneously or successively. Frequently there are several consecutive periods of activity succeeded by symptomless intervals, after any of which resolution or suppuration may occur. As a rule, constitutional symptoms, if any, are trivial. Fever is generally absent, but occasionally there is a moderate rise in temperature. The initial symptom is pain, followed by tenderness and swelling in one or more bones. At first the pain is vaguely seated and fleeting, but it soon localizes and becomes lancinating, and is more acute at night than during the day. The least pressure exacerbates it. Not until some days after the onset of the pain does tumefaction appear. The lump develops slowly and is usually confined to a limited area. In a few cases the pain is the sole symptom of the bone involvement. Even after weeks or occasionally years of freedom from symptoms the pain and swelling may reappear at the same or another site and an abscess form. More than one such oscillation may occur, followed by complete cure or suppuration. The skin at first is healthy. Only later does it become thin, violaceous and fixed. If abscess occurs, fluctuation may be detected. Local heat is but rarely present. The leukocyte count is usually within normal limits, but a leukocytosis of 15,000 to 20,000 has been observed with a polymorphonuclear ratio up to

89 per cent. According to Matthes, a persistent bradycardia in inflammatory bone disease is suggestive of typhoidal infection. The presence of this sign in an arthritis suggested to him the possibility of its typhoidal origin. The correctness of the impression was confirmed by bacteriological studies made after the death of the patient, a man, aged forty years, who had had typhoid fever when fifteen years old. Any or all of the bony constituents may be involved; thus have arisen the various terms used in describing the malady, namely, periostitis, osteoperiostitis, osteomyelitis, bone abscess, etc. A periostitis may terminate by the formation of exostoses.

This affection has been mistaken for luetic, tubercular, sarcomatous and the common pyogenic bone diseases. Syphilitic involvement of the long bones, the tibia and femur excepted, is unusual. Lues is preëminently a disease of the flat bones. When the long bones are affected there is a marked tendency to bowing. Its symptoms are less acute, the osteoscopic pain more pronounced and suppuration more infrequent than those consecutive to typhoid. A positive Wassermann test, a characteristic luetic skiagraph, a history of a syphilitic taint and a benignant antiluetic treatment are most helpful in cases of doubt. Tuberculosis preëmpts the epiphysis. Seldom, if ever, does it involve the shaft primarily. Pyococcic osteomyelitis occurs at the same age as the bone lesions consecutive to typhoid, and, like the latter, by preference attacks the tibia. But typhoid osteitis is practically always preceded by enteric fever; its evolution is not so rapid, its fever not so high, the leukocytosis not so marked nor the pain and tenderness so intense. Sarcoma announces itself by tumor formation, evident to both sight and touch, as well as by the distinctive shadowgraph registered on the roentgen-ray plate.

The disease usually runs a benign course. Either the plastic or the suppurative type may subside spontaneously.

There is a marked tendency, however, to chronicity. Among others, Klemm, Würtz, and Urbantschitsch have reported fatalities.

Prevention is rather to be desired than cure. Patients recovering from typhoid fever should be warned against injury to the osseous system and fatigue. For pain, repose in bed, friction and hot compresses have been used with success. The question of surgical intervention is largely a matter of judgment. Some cases resolve spontaneously; others are cured by simple incision and drainage, and still others require repeated operations before the disease is finally brought under control. Especially is this true of incomplete operations upon the costal cartilages. As a rule the entire cartilage must be excised to obtain a permanent cure. Insufficient operations lead to sinus formation, which may persist for years. Whenever operation is undertaken the medullary canal should be opened, otherwise hidden pockets of pus and sequestra-containing cavities may be overlooked, thereby subjecting the patient to an ineffective ordeal. Most surgeons have thought it necessary to drain these wounds, but Unger, Dupraz, and Lilienthal closed their incisions and obtained healing by first intention. The status of vaccine treatment is still unsettled. Some observers have reported remarkable results. Sharpless, Rosenberger, Emile-Weil, Sicard and Robineau, and Dachtler have conclusively shown that under the influence of vaccines typhoidal osteomyelitis can be cured with the greatest rapidity. Emile-Weil has treated 18 cases with stock solutions of triple vaccine, 2 of which were consecutive to paratyphoid bacillus. An account of these cases was incorporated by Chéron (*Thèse de Paris*, 1921) into his inaugural thesis. Unfortunately, I was unable to obtain this publication. The reports of 5 of these cases were published in the early part of 1917, with the following results: Cure in three weeks of a suppurative typhoidal fistula of two years' duration after 7 operations had proven futile; cure in one

week of a patient suffering for eleven months after 3 unsuccessful operations; amelioration in 2 cases after fifteen days of treatment; failure in a single instance only. Later, in 1917, in conjunction with Chevrier, he records 7 additional cases. 2 non-suppurative cases treated with vaccine alone had remained completely cured more than six months. Of the suppurative, 1 was cured, 2 improved and 2 unsuccessful. The injection may be made into the lesion or at a distance. Sicard recommends sixteen injections at two-day intervals. Sharpless injected first 90,000,000 dead bacilli, followed at ten-day intervals by 180,000,000. Rosenberger closed a fistula after seven injections of an autogenous vaccine.

The purpose of this paper is to call attention to osteomyelitis as a relic of typhoid fever, to tabulate the cases in which the Bacillus typhosus has been found and in particular to place on record 2 additional cases.

Case I.—A white female, aged twenty-four years, entered the University Hospital, Baltimore, October 11, 1921, for a soreness in the right thigh. In August, 1920, she had had typhoid fever of eight weeks' duration. Her convalescence was uneventful until eight weeks after defervesence, when she was suddenly seized with a lancinating pain in the lower part of the right thigh. After a few days this ceased as suddenly as it appeared. In January, 1921, she was delivered instrumentally of a full-term but dead infant. The death was attributed by the physician in attendance to the length of the labor, not to a constitutional diasthesis. No ill-results followed the confinement and the patient was about her household duties in the usual time. Three months later, while apparently enjoying the best of health, she experienced, without warning, a repetition of the pain. Like the first attack this gradually subsided. Since the initial attack there have been five distinct recrudescences of the complaint, similar in all respects to the first, but less

severe. The present attack began six weeks ago. Three days later she had a chill. Her condition gradually became worse and two weeks ago she had to go to bed. Even with the leg at rest the pain did not subside, and she sought the hospital for relief. Upon examination the affected leg looked normal; the skin was natural in appearance and the soft tissues not noticeably swollen. Deep pressure over the middle and inner aspect of the femur caused intense suffering. At this point the right thigh measured 16½ inches, the left 15¾. The femur itself appeared thickened. The knee could be flexed voluntarily, but the act was very painful. By October 18, the local symptom, had all become accentuated and fluctuation was definitely determined. The temperature had ranged since admission between 99° and 101°. No history of traumatism could be elicited. The blood Wassermann was negative; the Widal negative; the leukocytes 20,000, with a ratio of 89 per cent polymorphonuclears, 10 per cent small mononuclears, and 1 per cent large mononuclears. The radiographer reported thickening and roughening of the periosteum along the middle third of the shaft of the femur, suggesting an osteomyelitis. Despite the high leukocytosis and the negative Widal, the history of a preceding typhoid, followed by numerous attacks of pain in the bone, with periods of activity and quiescence, led Dr. W. H. Smith, to make a diagnosis of post-typhoid osteomyelitis, for the relief of which an operation was advised.

On October 19, 1921, with the patient under ether, Shipley incised the abscess and a quart of yellowish-green, odorless pus escaped. The femur lay free in the abscess cavity. The periosteal covering of this bone had been completely destroyed. Several small sequestra were seen protruding from the femur. These were removed. A hole was bored into the medullary canal and a considerable amount of flaky pus set free. A second trephinement was made about two inches above the first and a rubber tube was inserted for Dakinizing purposes. The abscess cavity was packed with plain gauze. September 1, 1922, the patient reported

the wound was still discharging. Cultures made from the pus obtained at the operation grew the typhoid bacillus alone.

Case II.—The patient, a white man, aged seventy years, entered the University Hospital, February 3, 1921, for relief from a discharging sinus in the lower and front part of the right side of the chest. He had had an uncomplicated attack of typhoid fever in the summer of 1920. The first intimation of anything wrong was during convalescence, when he noticed a tenderness at the site indicated. The discomfort, instead of improving, gradually increased; the skin became red and glistening; an abscess finally formed and broke open. On admission there was seen over the eighth costal cartilage near the sternal margin a sinus from which pus exuded. Temperature 98°, pulse 60, respiration 20. A roentgen-ray examination did not reveal necrosis of either the rib or the cartilage. The clinical impression was post-typhoid perichondritis. Operation, February 3, 1921; operator, Shipley. As the man's condition did not warrant a general anesthetic, the operation was undertaken with local anesthesia, 5 per cent procaine. The sinus was freely opened down to the cartilage of the eighth rib, which was found to be the seat of a suppurative perichondritis. The diseased portion of the cartilage was excised, the soft tissues thoroughly curetted and three Dakin tubes inserted. The sinus persisted, however, until July 28, 1922, when it closed spontaneously, never to reopen. In this case no cultures were made until nine months after the operation. Although a sinus had existed all this time, the culture yielded Bacillus typhosus alone.

A third case, undoubtedly typhoidal in origin, came under my care during the same period. The patient, a white female, had had a typical attack of typhoid fever two years previously, from which she made an uncomplicated recovery and was well for a year and half subsequently, when her attention was directed to a painful lump over the sixth left

costal cartilage near the sternal end. Gradually but progressively the mass increased until it had reached the size of a hen's egg. It was round, tense, non-fluctuating and apparently fixed at its base to the rib cartilage, but not very sensitive to touch. The overlying skin was bulging but not inflamed. The woman's general health was unimpaired. The patient was told the mass was probably a typhoidal chondritis, but she feared cancer and demanded its removal. So on June 5, 1921, under ether anesthesia, an incision was made into the mass, permitting the escape of a few drops of a thick, odorless, sticky, creamy pus. The entire cartilage together with a portion of the adjoining rib and sternum was excised and the wound closed with the exception of a small aperture for the emergence of a gauze wick. A rapid cure resulted and the patient reported, October 10, 1922, that she had had no further recurrence of the trouble. Cultures were not made because the operation was done in the patient's home.

In my search of the literature, I could find only 101 cases of osteomyelitis in which the Bacillus typhosus was recovered. An analysis of their salient features gives the following information:

Males	65
Females	29
Not given	7

Age, number in each decade:

1 to 10	4
10 to 20	20
20 to 30	26
30 to 40	16
40 to 50	12
50 to 60	1
60 to 70	2
70 to 80	1
Man	8
Boy	2
Girl	1
Not given	8

The youngest patient was two years old, the oldest seventy, 24 were under twenty, 50 under thirty and 32 over thirty; the remainder were merely described as man, boy, girl or not at all.

The time of onset of the bone manifestation was:

During attack	9
First two weeks of convalescence	11
Second to sixth week of convalescence	8
During convalescence (time not specified)	53
Months or years after convalescence	20

The lesions varied from small superficial areas of caries to extensive destruction of the bone.

Progress:

Died	9
Cured	48
Healing	8
Bone still enlarged	1
Persisting sinus	10
Not stated	25

4 patients required two operations before cure and 1 submitted to three operations.

18 were of the acute type; 83 chronic.

When sequestra were met with they were described as small and were rarely over an inch long.

Seldom was the diagnosis made or even suspected before the bacteriology of the pus was investigated.

I did not find a single example of vertebral abscess substantiated by bacteriological examination.* Raymond and Sicard mention having performed a laminectomy for an extradural lumbar abscess, but take pains to specify that the bone was not diseased. Guyot attributed a lumbar abscess to the ravages of typhoid, but said the patient did not present anything abnormal in the backbone, nor did he make any bacteriological study of the pus.

* Since writing this paper, Turner, *British Medical Journal*, 1923, i, 142, reports a case of suppurative typhoidal spondylitis from the pus of which the bacillus of Eberth was recovered. He states this is the only positive case of typhoid spine complicated by suppuration.

7 cases were reported as having followed an injury and 1 at the site of an old fracture.

Bigelow tells us of 3 people having been infected with typhoid by a man with a sternal sinus.

It is indeed remarkable that a disease as common, as crippling, as stubborn to treatment as typhoid osteomyelitis has received so little attention.

Conclusions. 1. Persistent bone pain with the history of a previous typhoid fever should suggest the possibility of a typhoidal osteomyelitis.

2. In suppurative bone disease a careful investigation of the bacteriology of the pus is necessary for an accurate diagnosis.

3. When suppuration occurs surgery offers the patient the surest and quickest road to complets cure.

4. Vaccinotherapy has been used with success in a few cases, both suppurative and non-suppurative, with and without operation.

Bacteriological findings:

Bacillus typhosus alone	94
Bacillus typhosus and Bacillus coli communis	2
Bacillus typhosus and Staphylococcus pyogenes aureus	1
Bacillus typhosus and Streptococcus pyogenes	2
Bacillus typhosus and Staphylococcus pyogenes citreus	1
Bacillus typhosus and pneumococcus	1

Number of bones attacked in each case:

1 bone	68
2 bones	23
3 bones	2
4 bones	2
5 bones	4
6 bones	2

These figures show a total of 160 bone lesions in the 101 patients.

Bone attacked and number of times:

Tibia	56
Femur	27
Ribs and costal cartilages	27
Ulna	9
Radius	7
Mastoid	6
Sternum	4
Metacarpal	4
Clavicle	4
Humerus	3
Metatarsal	3
Parietal	3
Phalanx (hand)	2
Temporal	1
Ilium	1
Frontal	1
Pubic	1
Fibula	1

Metastasis to the costal cartilages:

Under 20	1
20 to 30	5
30 to 40	6
40 to 50	9
50 to 60	0
60 to 70	1
70 to 80	1
Young man	1
Not given	3

While infection of the skeletal system in general shows a predilection for people under thirty, that of the costal cartilages occurs more frequently at a later period, namely, 6 below and 17 over thirty.

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DISCUSSION ON THE PAPERS OF DRS. LEWIS, SINGLETON, REDER, GILCREEST, KIRCHNER AND WINSLOW

Dr. Robert Carothers, Cincinnati, Ohio.—We have had so much material presented to us this evening that one hardly knows where to commence and where to end if he were to give these papers the discussion that they deserve.

There are some fundamental rules that one must follow in the treatment of fractures: First, get the bones in apposition, reduce the fracture; get them in apposition, if not in one way, another; ordinarily, if that cannot be done, cut down and put them in position. Second, maintain apposition until the process of repair takes place. Maintenance is a big problem and is a thing much discussed. Third, study the patient, which is very important, and take care of the patient during the process of repair. That is one factor I want to lay a good deal of stress on, because if it is followed out I think in many cases non-union and perhaps malunion might be avoided. If a Wassermann is positive the administration of KI or thyroid extract and a lot of things, besides the care of the individual, are important during the process of repair. Fourth, restoration of function of the injured part after repair takes place. This one feature in the past has been very much overlooked. That is the reason we have osteopaths and chiropractors. We have made these fellows, and they do not make themselves in many instances.

A fracture of the shaft of the femur is a nice thing to treat, and I am surprised at the results we saw twenty-five years ago. I believe in those days our results were just as good as they

are now, and we did not have a Hawley table and a good many other things we use today.

Let us take a fracture of the femur. I put the patient in a plaster spica and get the bones in position if I can. I would put on next a plaster jacket encasing the ribs clear down and including the foot. Then I study the case. I take a plaster spica and cut it around the ankles. Before we had the fluoroscope we did it the best we could with our hands. With the fluoroscope we can get the bones in position, having a block tackle pulley and pulling the fracture into place, and then using plaster of Paris; in many instances we obtained good results.

Another thing: I like to get these patients on their feet in the ambulatory treatment of old fractures as soon as possible. I remember having eight thigh fractures in the ward of the hospital at one time, all striving to help each other, which was of great assistance to the nursing staff of the hospital.

With reference to Pott's fracture, we treat these fractures by putting them up in plaster in extreme abduction and rotation inward, keeping them that way six weeks, letting them go about at the same time, then putting them up in a splint that catches the heel of the shoe, with a starched piece around the ankle and the other piece under the knee, and starting them walking about at the end of six weeks.

Dr. J. Garland Sherrill, Louisville, Ky.—There is one point I wish to touch on because I do not think its importance has been sufficiently emphasized in the treatment of fractures, and that is, the relaxation of muscles to overcome deformity. Traction is a very good thing, but it will not overcome the deformity that exists where there is a tilting of the bone through the contraction of the muscles.

In a fracture of the femur near the lower extremities, with overlapping, the upper fragment lying on top of the lower fragment, I have seen many men try to overcome the deformity by traction in a straight line, yet fail to get apposition. You should flex the knee completely, then if you make slight traction you get a beautiful result; whereas if you try to overcome the muscle you will fail signally. The same thing is true of fractures of the upper part of the thigh. The inclined plane should not be abandoned. Many of the old methods can be employed with great benefit, and it would do us all good to review the

work of the older men in medicine and surgery in the treatment of these conditions. Many of the aphorisms on the subject of fractures advanced years ago can be followed with advantage today. Relaxation of muscles in the reduction of deformity is a valuable means in the treatment of fractures and should be utilized more frequently than it is at the present time. If necessary, when we have tilting do a tenotomy, which is a simple and less dangerous operation than the open operation, and if we fail in these measures the open operation becomes available.

Dr. Isidore Cohn, New Orleans, La. (by invitation).—I think the teachings of Dr. Lewis and Dr. Gilcreest regarding the treatment of fractures in general should be more generally diffused, particularly with reference to one statement Dr. Lewis made, that the treatment of fractures should be along anatomical lines. Because many attempt reduction of fracture deformities without regard to muscle origin, insertion and action and without regard to brute force used, or they make use of traction tables which do not take into consideration muscle action, they resort early to the treatment of fractures by open operation.

Dr. Gilcreest has shown us what I believe are wonderful results in the treatment of fractures at the elbow-joint. They are the best I have ever seen demonstrated anywhere. He called attention to the principles of treatment, and particularly to the anatomical lines described by me.

In the work in which we have been doing we have been very much impressed by certain anatomical lines, and with the importance of the roentgen ray interpretation of joints in childhood. Two or three lines have served us well in the treatment of elbow fractures. If the elbow is flexed at a right angle and we pass a plane through the middle of the long axis of the humerus normally, from one-half to two-thirds of the lower articular surface is anterior to the plane passed through the middle of the shaft. If after fixation the plane lies posteriorly to the articular surface, you know the patient has a deformity and limitation of function, and you have to do something.

Dr. Gilcreest, in speaking of the lower epiphysis of the humerus, mentioned the external epicondyle. I wonder if he means to convey the idea that this is a constant epiphysis.

In a study of the lower epiphysis of the humerus which we have made from an roentgen ray standpoint, we have found only three epiphyses present constantly, one for the capitellum, one for the trochlear and one over the internal epicondyle. It was a rare thing in our study from birth to complete ossification that we have found the external epicondyle as a separate epiphysis. In most instances it seems to be an upward growth of the capitellum.

Dr. W. Burton Thorning, Houston, Texas.—There was one point brought out in Dr. Lewis' paper which leads me to ask the question, are we seeing more cases of nonunion today than we did twenty-five years ago? Dr. Lewis has explained this by saying that with the advent of the roentgen-ray machine we have been losing some of our tactile sense. It would seem to me that we have been paying less attention to the fundamental principles in the treatment of fractures than we did when we started out in our fracture work before the advent of the roentgen ray. There are those of us who would be unwilling to admit that we know less of the principles of treatment of fractures than we did in those days, but I am convinced that we are seeing a larger number of cases of nonunion. I speak of this because I hope Dr. Lewis in his closing remarks will elaborate on that point and tell us if there are any other reasons for what seems to me a certain increase in the number of cases.

Dr. E. Denegre Martin, New Orleans, La.—I had not intended taking part in this discussion, but I want to make a plea for a simple method in the application of plates. In using plates and machine screws, such as are sold to surgeons by instrument houses, it is necessary to have the drill hole smaller than the screw. For the past five years I have used carpenter screws, and the advantage is this: The short machine screw is fixed to the proximal side only, and, as the ebonized bone is a mere shell, an extra turn even in the properly drilled hole will cause it to destroy the thread and you might as well have a tack, as the least motion will pull out the screw. A carpenter or wood screw long enough to go through the bone and become fixed to the distal side of the shaft will hold far better, and is doubly secure. Drill the hole on the proximal side large enough for the shoulder of the screw to pass through

easily and drive the end into the distal side by the force of the screw-driver, which can be done without drilling in most cases.

I have had a number of oblique fractures which are comparatively common. I have seen a band put around such a fracture, always with difficulty, whereas it is an easy matter to put a carpenter's screw through the oblique end and you get the same results. If you wish to take it out later (I have never had to) you can do so at any time with local analgesia. Recently in a fracture of the humerus it was impossible to put on a band without danger to the musculospiral nerve. I suggested this method, and the patient has a good result. Get the length of the screw by measuring the shadowgraph. You need nothing but an ordinary screw-driver and there is little danger of stripping the threads in the bone. I have given up the idea of buying expensive screws, when I can go to a carpenter and for five cents get a dozen screws.

Dr. Kirchner (closing).—I have been asked why I did not operate on the case I presented. I first saw the patient three months after the original injury, and at the time the shell was applied he was so weak and in such a precarious condition that operation was out of the question.

The indications for operation on the spine maintain just as they do in head injuries or in cases of fracture of the skull. If there is compression I believe the sooner it is relieved the better. That is my answer to the operative side. Aside from that, I have nothing further to say.

TREATMENT OF DIVERTICULUM OF THE ESOPHAGUS

By Charles H. Mayo, M.D
Rochester, Minn.

Diverticulum of the esophagus has long been known and described. The rarity, lack of examining facilities, especially before the utilization of the roentgen ray, have delayed a thorough understanding of the condition. Bell, in 1830, recommended and made an external fistula into the sac. Rokitansky, in 1840, described and made two classifications of diverticula of the esophagus: (1) the pulsion or pressure sacs forced out from within, and (2) those caused by traction. Kluge, in 1850, recommended extirpation. Zenker and Ziemssen, in 1877, described the condition often called the Zenker pharyngo-esophageal diverticulum. It is probable that Nichaus, in 1881, made the first extirpation.

Diverticulum of the esophagus, a disease of adult life, is more common than generally realized. If it were regarded as not uncommon, those causing symptoms might be discovered early when the sac is small or at least before it becomes intrathoracic. Almost all such patients observed in the Clinic have received treatment for throat trouble or difficulty in swallowing for a considerable period, and a large percentage of cases were unsuspected as such. In some instances the condition was believed to be due to stricture, benign or malignant. The pulsion diverticula are pushed out from within by violent peristaltic action at this, the narrowest part of the canal behind the cricoid. The

traction type of diverticula are small and are situated at about the level of the bifurcation of the trachea; they are usually caused by the suppuration of infected glands. They are rare, being found most often at necropsy, and seldom cause similar symptoms. They probably occur under tension; some may be congenital but not progressive. Judd reports a case seen in the Clinic of congenital stricture of the esophagus causing a diverticulum-shaped pouch in the upper esophagus in a child of twenty months who was cured by one dilatation.

All of the pulsion type of diverticula eventually become surgical with increasing severity of symptoms. They occur directly back of the cricoid cartilage on the posterior wall of the esophagus at the juncture of the pharynx and the esophagus. The weakness of the muscles and its covering at this point was noted by Lannier and by Hackerman, and is called the Lannier-Hackerman area. This is where evolution in changing the cephalic stomach and straight gut of invertebrate life to the anterior or vertebrate position, united the mouth with the esophagus. A more common point for diverticulum to occur from congenital defect is where the intestine, in development, is enclosed within the abdomen at the umbilicus, known as Meckel's diverticulum. Once the esophageal muscle is penetrated, the sac gradually enlarges and develops a semi-inflammatory or traumatic thickening of the fibrous tissue, at first in the middle line growing down in front of the spine, then bulging to the sides and increasing usually somewhat more to the left. The large sacs grow into the mediastinum, becoming intrathoracic; once there they increase more rapidly in size. Such sacs holding approximately a pint of material each have been seen in the Clinic. The wall of the sac, when large, is much thinner, the layer of mucous and fibrous tissue being about 0.15 cm. thick and more fused. The small sacs are somewhat thicker in the fibrous layers, less in the mucous, and are more easily separated.

Symptoms. The inception is probably rarely recognized, as it is only possible when there is trouble in swallowing. Later irritation of the trachea and pressure on the recurrent nerves may lead to a troublesome cough. A varying degree of dyspnea may occur with pressure; both conditions indicate a probable intrathoracic sac. The difficulty in swallowing (dysphagia) is much like that of stricture or malignancy.

Diagnosis. The larger sacs become direct continuations of the upper esophagus. It is difficult for sounds or probes, even if small, to be passed down the esophagus without slipping into the sac. Dr. H. S. Plummer early developed the use of the silk-thread guide. One end of about five yards of thread is swallowed and the other pinned to the clothing; usually within a few hours, or a day, the thread passes through the stomach and far enough into the intestine to stand traction. This method was first used by Mixter, of Boston, as a guide in dilating strictures of the esophagus. By threading the silk through the end hole of a sound or olive-tip probe and drawing it taut, the instrument which previously is stopped at the end of the sac now passes directly to the stomach along the thread guide. Plummer's suggestion, in addition to its common use, is to hold the thread less taut and to pass the probe to the bottom of the sac, then the distance the rod is elevated by tightening the thread, until the probe passes into the opening in the anterior wall and down the esophagus, gives the exact depth of the sac. The thread is swallowed afterward and passes through the intestine. The esophagoscope is of some value, when available, in the examination of these cases. Such modifications as swallowing a chain, inserting a shot-filled tube for fluoroscopic examination, the Strauss method of measuring the capacity of sac, and dilatation by their distention with air-blown rubber balloons passed empty on stomach tubes, are no longer necessary. While small sacs give trouble enough, patients with large sacs are often greatly emaciated by long starvation. In such cases a small stomach

tube or a large catheter is passed down the thread and daily feedings given to prepare the patient for operation. This method of building up the patients is most satisfactory and makes gastrostomy by tube, recommended by König, Payr and Bevan, rarely necessary. The sacs, by enlarging the neck, are often of sufficient size to be seen. On compression the fremitus of air and fluids is distinctly felt and often the contents can be partly regurgitated into the mouth. The visual test, by roentgenograms, is of the greatest value. The barium emulsion is given in an amount more than sufficient to fill the estimated capacity of the sac and a roentgenogram made which gives accurately the depth, location and size, rendering other methods unnecessary, with experience in reading the plates. Considerable dilatation above a high stricture may occur, but the narrow line of barium is seen passing down through the esophagus stricture below the pouch.

Treatment. Several methods have been devised for removing or obliterating the sac. It has been suggested to pass forceps to the bottom of the sac, open them, grasp the inside of the sac, draw it up like the finger of a glove and push it down the inside of the esophagus. This method does not appeal to a surgeon, as even the small sacs for which only it might be considered, are fairly well fixed by adhesions. External surgical removal in one or two stages, change of position, or obliteration are the methods of choice. If a general anesthetic is used the sac must be well emptied before operation. About thirty years ago, while I was bringing up a large intrathoracic sac, the patient, who was under a general anesthetic, almost suffocated by the contents pouring into the trachea; he very nearly died later from bronchopneumonia. This experience led to the employment of a local anesthetic, usually novocaine, with some preliminary morphine, in practically all such cases.

According to the literature, only a few hundred patients with diverticulum of the esophagus have been operated on.

Although the condition is benign, the mortality has been as high as for more serious operations, such as malignant conditions in the abdomen. In one series of 200 collected cases reported in the literature there were 16 deaths; in another of 109 cases, 12 deaths, and in 1 of 100, 10 deaths after one-stage operations, and 28 fistulas. Some time ago Judd presented a record of 52 cases operated on at the Clinic, with 3 deaths. The number of cases has now been increased to 74, without further mortality.

To me the size of the sac (seldom mentioned in literature) is an essential point. All surgeons recognize the danger of acute infective conditions of the mediastinum. When the sac is small the surgeon has a choice of procedure, but a two-stage operation with the sac unopened at the first operation is necessary in those cases in which the sac extends to the thorax. In a few cases the cause of death is given as bronchopneumonia. I believe the condition may result when a general anesthetic is given and the contents are expressed above the tracheal opening for aspiration into the lungs. Certain surgeons, notably König, recognizing the dangers of infection, cellulitis and the troubles of fistula, elevate the sac, fixing its fundus to the hyoid bone. Wildenberg in 7 cases reversed or changed the direction of the sac, later removing 3 of them. Liebl fixed the sac to the skin incision, leaving it unopened. Ligating the neck of the sac, leaving it to slough out of the packed wound, has been recommended by von Beck, who reported 2 deaths from pneumonia in 7 cases. Goldman, at an early period, showed by this method 65 per cent of fistulas with septic cellulitis and slow healing. Murphy delivered the unopened sac through the incision, twisted it and later amputated and closed the fistula, a method used in 1 case in the Clinic with success. Girard, in 1896, invaginated the sac by suture in 2 cases. Von Beck invaginated the sac by suture, double suturing and reefing to obliterate it without opening. Bevan, at the suggestion of Sippy, performed this operation evidently

on a large sac, as he used two or three purse-string sutures to invaginate the outer part of the sac and reefing sutures for the lower half, leaving the sac compressed at its attachment. His report suggests that 1 patient died because the sac invaginated into the esophagus, and being forced upward by vomiting, caused suffocation from blocking the trachea. He mentions the advisability of removal of half of large sacs and reefing the remaining half.

Bensaude, Grégoire and Guénaux believe the one-stage operation best and that the two-stage is an unnecessary precaution. I believe, with Hartman, that the danger of such procedure is too great in the case of large sacs for the little that is gained in time.

The operative incision usually recommended is parallel to the anterior border of the sternomastoid muscle. A better incision is one made in the line of the natural crease of the neck, one-third being behind the anterior border of the sternomastoid and the skin and platysma muscle dissected both ways from this line; this affords a blunt dissection with hardly a vessel to ligate. With blunt retractors, the sternomastoid and the omohyoid muscles, the internal jugular vein and the common carotid artery are drawn back; anteriorly the sac is seen just behind and extending below the cricoid cartilage. In one of my earlier cases I deemed it advisable to pass a ureteral sound through the mouth into the esophagus and to push the sac into the incision, an unnecessary procedure, but one recommended by Deis. Bartlett suggests a method to identify the sac which I have not as yet had opportunity to test. With incision and dissection complete to the region of the diverticulum, the patient, being under a local anesthetic, is instructed to close the lips and distend the mouth and pharynx with air, and thus distend the sac. This is a simple procedure and well worth trying. The sac is lighter colored than the surrounding tissues and has a small plexus of veins over it. Carefully held by forceps, blunt dissection

separates it from the tissues in contact, and this is facilitated by a piece of gauze held in artery forceps. Large sacs are drawn up from their intrathoracic position with but little added difficulty, care being taken not to open or injure by rough pinching with forceps.

In both small and large sacs there is little difficulty in amputating and suturing at the juncture with the esophagus, using two rows of chromic catgut and a small soft rubber drain. The technical difficulties are not great. Gauze, often mentioned as a drain, should not be used in a suture case on account of the added danger of fistula.

Large sacs should be delivered unopened, packed around with a layer of gauze or placed within a soft rubber drain, to prevent healing to the incision and skin, and should be amputated and closed by suture in from ten to twelve days.

In the period between the first and second stages of the operation the mediastinal space becomes closed and protected by granulation tissue. I believe that the success and low mortality shown in the treatment of an unusually large number of these patients during the last thirty years justifies the safety of the method and this additional report concerning it.

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DISCUSSION

Dr. Williard Bartlett, St. Louis, Mo.—Such a paper as Dr. Mayo has presented should not be allowed to go by without some discussion. I should like to add a personal experience to what Dr. Mayo has given us, and that experience is this: Having had more difficulty than he had in identifying the sac on a previous occasion, when I had one of these cases recently I did the operation under paravertebral anesthesia and was then easily able to find the sac, which was only in the neck. By asking the patient to blow there was no necessity of having anything in the sac from inside the mouth as others have done. Surgeons will find this experience most helpful. The patient is asked to blow, and shows where the sac is by distending it.

Dr. Mayo (closing).—I am glad Dr. Bartlett brought out the point that he did concerning the locating of an esophageal diverticulum by having the patient close the lips and fill the upper pharynx with air, the distention pressing out the sac into the incision making it easy to identify it from the surrounding tissue; this is practically always available as these operations are done under a local anesthetic.

ACUTE ATROPHY OF THE LIVER WITH NODULAR HYPERPLASIA

By E. H. Pool, M.D.

and

F. W. Bancroft, M.D.

(By Invitation)

New York, N. Y.

Acute yellow atrophy of the liver is of some interest to the surgeon, first, because in the subacute or chronic cases the symptoms occasionally lead to unnecessary and unfortunate exploratory operations, and, second, because the operative findings in such cases are likely to be wrongly interpreted. Two cases which illustrate these features are the basis of this contribution.

Acute yellow atrophy of the liver is characterized by marked diminution in the size of the liver, which often becomes reduced 50 per cent in less than two weeks. The etiology is obscure. The condition has been attributed to infection, to the action of some toxin or to a combination of these two. Nothing, however, is actually known as to the character and source of the etiological factors. The disease occurs in apparently healthy individuals, as well as in those who present some acute or chronic infection.

The symptoms develop insidiously and consist for the most part in headache, digestive disturbances (as vomiting and epigastric discomfort), jaundice, moderate fever, and later delirium, convulsions and coma. Many cases ter-

minate fatally in a few weeks, but some persist for months. We will not dwell upon the clinical features other than to state that they usually present a picture sufficiently definite to warrant a probable diagnosis and to indicate examination of the urine for leucin and tyrosin, the presence of which is strongly corroborative. But on account of the rarity of the disease, this is often not thought of, as in our cases.

The first significant pathological change consists in fatty disintegration of the liver cells, as a result of which the liver enlarges. Rapid absorption of the products of disintegration follows with diminution in the size of the liver. The destroyed areas present only connective tissue with large numbers of tubules like small biliary ducts. Localized areas of hyperplastic liver tissue develop, apparently representing a compensatory reproduction of the lost hepatic parenchyma. The appearance of the organ depends upon the stage of the disease. The hyperplastic changes are noted particularly in the prolonged cases and constitute a late feature.

The lesion under consideration is of interest to the surgeon chiefly because of the great uncertainty and embarrassment which result when it is encountered at operation and not identified. The writers have each had such an experience. The liver, however, presents so characteristic a picture that the true condition should be identified.

The liver is much reduced in size; the major portion of its surface appears about normal in color, smooth and apparently not diseased; projecting from the surface are tumor-like bosses varying in size from about 1 to 4 cm. The main mass of the liver appears normal in color. These nodular excrescences suggest neoplasms and might be mistaken quite readily for carcinomatous metastases. In one of our cases they were of a congested red or bluish color; in the other, yellowish when seen at operation. The liver edge is extremely sharp and acute, and when palpated between the fingers gives a leathery feel. For biopsy one instinctively removes a portion of one of the

apparent new growths. This is one of the features worthy of emphasis, since the apparently normal liver substance between the nodules and not the bosses show the characteristic lesion, and it is from this normal appearing tissue that a biopsy should be made. This tissue shows absence of liver cells—that is, atrophy; the bosses present the picture of hyperplasia of liver tissue. Examination of tissue from one of them does not reveal the true lesion, which can only be inferred unless the liver tissue is available for study. A second feature worthy of emphasis is the wide difference in the apparance of the same organ when seen *in vitro* on the operating table and at autopsy. This factor has not received the attention it deserves. Pathologists describe the bloodless organ and the surgeon sees the organ distended with the circulatory blood. We are prone, then, to suspect in such unusual cases the conditions found in text-books and described by pathologists on the basis of examinations of bloodless autopsy specimens.

The condition of nodular hyperplasia has long been recognized and was accurately described years ago. Thus, in 1895, Marchand presented a full description of the pathological findings in such a case. Meder, at the same time, discussed the origin of the hyperplasia and concluded that it originates in the interlobular bile ducts. Little emphasis, however, seems to have been placed on the condition in recent writings.

Case I.—Female, aged twenty-one years, Russian, feathermaker, admitted December 6, 1915. Died March 30, 1916. Diagnosis: Acute yellow atrophy of the liver. The patient was always strong and healthy. History was negative up to three years before admission; since then she had "stomach trouble," which consisted chiefly in epigastric distress after eating, more especially after a heavy meal, and lasting an hour or two, but not severe enough to keep her awake. Chronically constipated. Epigastric pain

and burning rarely occurred oftener than one day a week; sometimes no oftener than once a month. No vomiting. Very little nausea. No jaundice. Painful and swollen glands on the left side of the neck for one week six months ago. Other details of the history are not important.

Present illness began about two weeks before admission, with gradual yellowing of the skin over the body. Stomach trouble became more constant, with epigastric pain and burning, nausea, loss of appetite and occasional vomiting after meals. No attacks of severe pain. Stools not observed. Severe headaches at times. Itching was severe in the second week. Nervousness and weakness since onset, but the patient was able to continue working until three days before admission. No glandular swelling observed recently.

Physical Examination on Admission. Well-developed, well-nourished girl lying quitely in bed. Appears acutely ill. No dyspnea. Pupils equal, regular in outline, react normally to light and accommodation. No nystagmus, strabismus nor ptosis. Scleræ slightly yellowish. Teeth poorly kept, pyorrhea present. Tongue protrudes in mid-line, not tremulous nor coated. Tonsils not enlarged or inflamed. Pharynx normal. Neck not stiff nor tender. No venous engorgement or abnormal pulsations. Thyroid appears slightly enlarged. No tracheal tug. On each side of the neck, but more marked on the left side, there is a marked swelling which on palpation proves to be several rather hard nodes. There are palpable nodes in the axillæ, inguinal region and popliteal space; nodes, however, are not greatly enlarged. Abdomen soft; no tenderness, rigidity or masses. Liver edge is palpable 2 cm. below the costal margin in the right mammillary line. The edge feels sharp and firm. No irregularities felt. Gall-bladder not felt. Spleen edge is palpable 1 cm. below the costal margin on deep breathing; feels firm. Kidneys not palpable. Knee-jerks present and equal. No pretibial edema, scars or thickening.

December 7, 1915. Stools, no bile present.

December 15, 1915. Stools, no bile, much mucus.

January 2 to 10, 1916. Coagulation time (6 tests) varied between three and eight minutes.

December 8, 1915. Serological examination of the blood. Wassermann negative.

January 8, 1916. Serological examination of the spinal fluid. Wassermann negative.

Blood Count. December 7, 1915. White blood cells, 6800. Red blood cells, 4,104,000. Hemoglobin, 80 per cent. Polymorphonuclear neutrophiles, 69 per cent; polymorphonuclear basophiles, 0; polymorphonuclear eosinophiles, 0; large mononuclears, 1 per cent; small lymphocytes, 30 per cent.

March 6, 1916. White blood cells, 21,000; polymorphonuclear neutrophiles, 76 per cent; polymorphonuclear eosinophiles, 0; polymorphonuclear basophiles, 0; large lymphocytes, 1 per cent; small lymphocytes, 21 per cent; large mononuclears, 2 per cent.

Urine Examination was always about as follows: December 7, 1915, Specific gravity, 1023; acid; dark amber color; no turbidity or precipitate; faint trace of albumin; no glucose. Microscopical, many epithelial cells. No casts. Bile. Urobilin.

Blood-pressure averages 110 systolic and 70 diastolic.

Temperature for the first two weeks ranged from 99° to 100.° On December 24, the temperature began to rise somewhat and about every third day was quite elevated, for instance, December 25, 103°; December 28, 102°; December 31, 104°. Leukocytes at this time were 12,000, with 66 per cent polymorphonuclears. From January 5 to March 4 the temperature ranged in general below 100°, with occasional slight rise above this. From March 4 to March 18 (date of the abdominal operation) the temperature became somewhat more elevated, 102° to 103° on several days, with leukocytes 20,000, 80 per cent polymorphonuclears.

January 3, 1916, supraclavicular nodes were removed for diagnosis. Pathological diagnosis: Endothelial hypoplasia of lymph nodes; no evidence of Hodgkin's disease or tuberculosis.

Aërobic and anaërobic cultures from macerated gland tissue sterile seven days.

Operation. Exploratory laparotomy, March 18, 1916. Gall-bladder normal. Liver presented on all the accessible parts rounded projecting nodules about one-half inch in diameter, projecting about one-quarter inch to one-half inch from the surface of the liver. These were dark blue in color. The surrounding liver was liver red. A piece of one of the projections was removed for microscopical examination, also a lymph node from the lesser curvature of the stomach. The peritoneal cavity contained about 2 quarts of thin, bloody fluid, which was removed with an aspirator. After operation the temperature remained under 100°; pulse around 92.

On the third day after operation the patient was restless, irrational and involuntary. On the fifth day she vomited about 12 ounces of dark brown fluid. On the eleventh day she became comatose. Pulse and respiration became rapid and weak. Twenty-four-hour specimen of urine, 17 ounces. March 29, 1916, patient in coma all day; did not void. Catheterized. Total urine, 12 ounces. Died. Partial autopsy. Nothing abnormal found except in the liver.

Pathological Report (elaborated by Dr. Elser after the operation). The following material was sent to the laboratory for examination: Bloody fluid from the peritoneum, which was cultured and proved to be sterile; two small lymph nodes from the lesser curvature of the stomach, which showed no specific histological changes, and a small piece of tissue removed from a nodule in the liver. Microscopical examination of this material showed the microscopic features of a hyperplasia of liver cells. The lesions are regarded as compensatory in nature and strongly suggest the existence of destructive lesions elsewhere in the liver.

Autopsy Specimen. March 30, 1916. The specimen consists of a portion of liver, several inches in diameter, removed after death through the laparotomy wound. The surface of the liver presents a slightly wrinkled appearance, is dark brownish red in color. The organ is leathery in consistence and its edges are sharper than normal. Projecting from the surface for a distance of about 2 cm. there are two irregularly circular, rounded nodules which measure respectively $3\frac{1}{2}$ x $2\frac{1}{2}$ and $2\frac{1}{2}$ x $1\frac{1}{2}$ cm. across and are softer in consistence and lighter in color than the surrounding structures. On section the liver is found to contain numerous circumscribed nodules of a light greenish color. The intervening structures are dark brownish red in color and fail to show the usual lobulations of liver tissue.

Microscopical Examination. Sections of the brownish-red areas show the usual features of the late stages, the so-called atrophy stage, of acute yellow atrophy of the liver. The pictures presented by sections taken from different regions of these atrophic portions of the liver are not wholly identical, but differ in accord with the varying degrees to which the process of repair and shrinkage has progressed in different parts of the organ. In general the sections show broad cellular bands representing the thickened and extended portions of the internal projections of Glisson's capsule and less cellular islands representing what remains of the original liver lobules. These latter regions show no cellular elements which can be identified as liver cells. They consist in the main of the original supporting structures of the liver lobules, variable amounts of debris representing the remnants of liver cells, extravasated blood, newly formed connective tissue and blood capillaries. In addition considerable amounts of blood pigment and numerous fat granules are found scattered throughout these areas. As already indicated the differences in the size and appearance of these areas in different sections are determined by the extent to which replacement of necrotic material by young

connective tissue has occurred and the varying degree of shrinkage of this scar tissue which followed.

The broad bands referred to above are densely infiltrated with round cells of the lymphocyte type and are traversed by numerous channels lined with epithelial cells and having the appearance of small bile ducts. These are for the most part newly formed bile ducts and represent attempts at regeneration. Whether these regenerative efforts eventually lead to the formation of new liver lobules or remain abortive in nature is still a much disputed question. Apart from ducts which are readily identified as bile passages there are numerous small collections of cells which approach in appearance liver cells, but are considerably smaller than adult liver cells. Concerning the exact nature and origin of these collections of cells there is considerable doubt. Some surround in an orderly manner minute canals which are filled with stagnated bile and are rendered visible because they are so distended. Other islands show no evidence of canalization, are not arranged in an orderly manner, and apart from their diminutive size suggest collections of liver cells. Whether these islands represent newly formed liver cells, and if so originate as the result of a budding process of bile ducts or from preëxisting liver cells cannot be determined without a more detailed study of serial sections. The presence of bile in some of these new-formed canals suggests that they do not communicate freely with the larger secretory ducts and may indicate that they are not at all connected with the biliary passages; but whatever the cause of the stagnation may be, the presence of retained bile affords a satisfactory explanation of the obstructive nature of the jaundice in these cases.

Microscopical examination of the circumscribed nodules shows them to consists of hyperplastic liver tissue. The lobules are somewhat deformed; the liver cells show irregularities in arrangement, and in places evidences of unusually active proliferation approaching neoplastic proportions

(marked irregularities in the size and staining peculiarities of the nuclei). Many of the liver cells contain bile pigment and in places the intralobular bile passages are plugged with bile, suggesting imperfect union with the extralobular bile ducts or partial obstruction or complete occlusion of the latter. The bile stasis indicated by the findings account in part for the jaundice observed in this case and also for the greenish tint of these areas noted above.

The connective-tissue stroma traversing these large islands of liver cells is infiltrated with round cells, but one misses the proliferating bile ducts, which suggests that these islands originated from preëxisting liver cells.

Case II.—Mrs. A. A., aged sixty-four years, April 9 to 15, 1922. Diagnosis: Acute yellow atrophy of the liver. Chief complaint: Attacks of pain in the right upper quadrant; nausea and weakness. Past history: Complete hysterectomy for fibroids, 1911. Has had gastrointestinal disturbances for years, with nausea. Bowels constipated. For several years has had nocturia four to five times per night. Has has occasional attacks of pain in the right lumbar region; moderate amount of pus in the urine. Six months ago the patient had an attack of influenza; did not regain her health; chief complaint was loss of appetite and weakness.

For the past four months the patient has suffered from indigestion, gas after eating and asthenia. She becomes exhausted after walking about one city block. She has had several attacks of pain in the right upper quadrant associated with nausea, but no vomiting until the present attack.

Present illness began about two weeks before admission, with gradual yellowing of skin over the body. Two days before admission she was seized with violent attacks of pain in the right upper quadrant, radiating to the lumbar region; marked nausea and persistent vomiting.

Physical Examination on Admission. Well-nourished

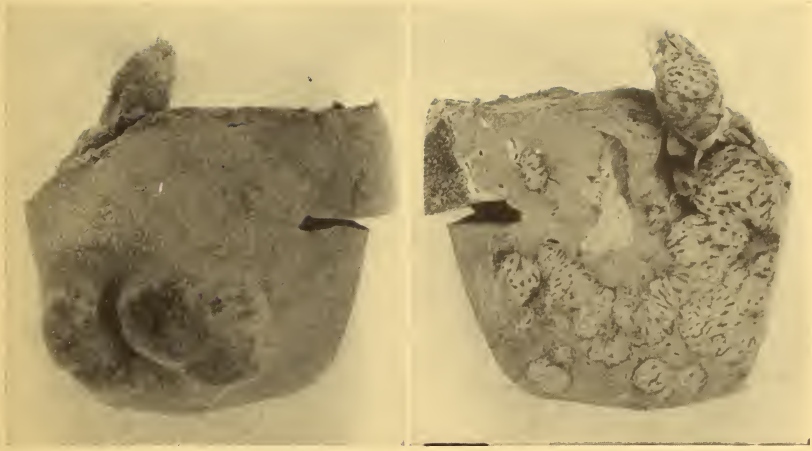

Fig. 1 (Case I).—At left, gross specimen of liver; at right, cross-section of same. Bosses appeared blue in color at operation; yellow at autopsy. Remainder of liver normal color but with knife-like edge.

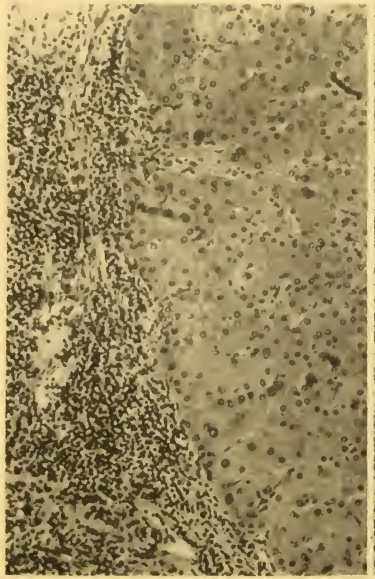

Fig. 2

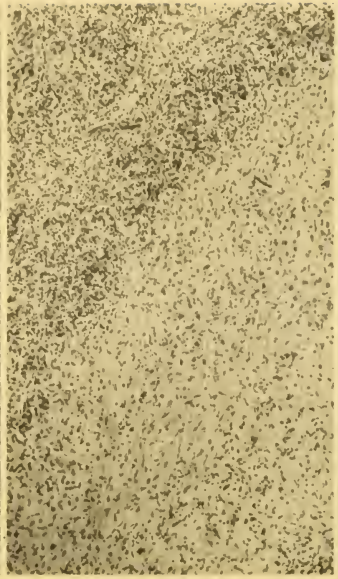

Fig. 3

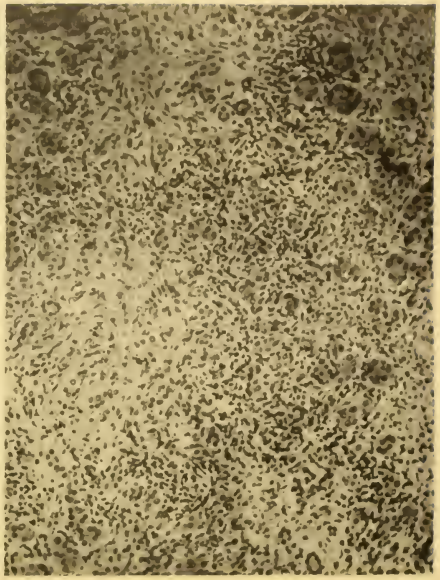

Fig. 4

Fig. 2 (Case I).—High power of border of area of nodular hyperplasia. Some liver cells showing double nuclei; marked round-cell infiltration of adjacent liver tissue.

Fig. 3 (Case I).—Atrophic liver. Structure of main mass of liver. Complete absence of liver cells. Section presents connective tissue (replacement fibrosis) with small round-cell infiltration and some cell detritus.

Fig. 4 (Case I).—Newly formed bile ducts and small round-cell infiltration adjacent to area of nodular hyperplasia.

Fig. 5

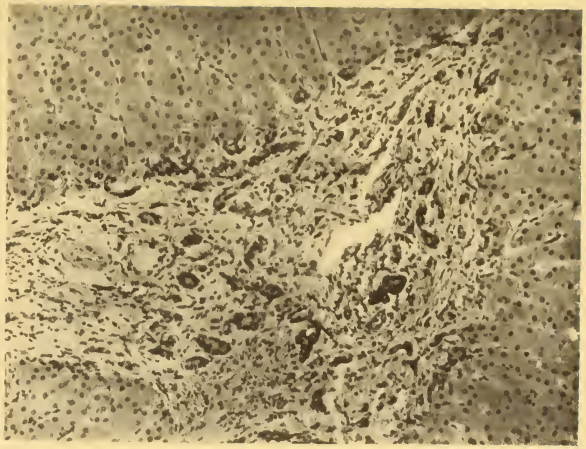

Fig. 6

Fig. 5 (Case II).—Gross specimen of liver. Marked atrophy of liver with raised bosses which represent areas of newly formed liver tissue (nodular hyperplasia).

Fig. 6 (Case II).—Area of nodular hyperplasia enclosing area of connective tissue containing numerous small bile ducts assumed to be newly formed.

elderly woman, who is up and about. Pupils equal and react to light and accommodation. Conjunctivæ of good color. Teeth in good shape; no pyorrhea. Tonsils negative. Pharynx normal. No enlargement of the thyroid. Heart and lungs negative. Abdomen: no rigidity; no masses felt. There is distinct localized tenderness in the region of the gall-bladder. No muscle spasms nor masses noted. Spleen and kidneys not felt. Vaginal examination negative. Knee-jerks present and equal. No pretibial edema or thickening.

Blood Examination: Coagulation time, three minutes; white blood cells, 9000; polymorphonuclears, 58; small lymphocytes, 20; large mononuclears, 22.

Urine Examination: Specific gravity, 1012; reaction, alkaline; albumin, very faint trace; glucose, negative; bile, negative; white blood cells, few.

Stools normal in color. Wassermann: negative. Five days after the patient was admitted to the hospital a fluoroscopic examination suggested adhesions about the gall-bladder and the duodenum. While in the hospital the patient became definitely jaundiced.

April 15, 1922. The patient went home.

May 2, 1922. Re-admitted to hospital. Was worse for a few days after returning home, but has improved slightly during the last week. Jaundice is less than during her last admission. She has had colon irrigations every day, but has remained obstinately constipated, with constant nausea and numerous fainting attacks with pronounced weakness.

Operation. May 3, 1922. Upon opening the peritoneal cavity several ounces of turbid bloody fluid escaped. Liver was found to be much smaller than normal, with numerous irregular raised areas, which were yellowish gray in color and elevated about ½ cm. above the surface of the liver. Other areas of the liver were red in color, but the edge was knife-like on palpation. Masses did not appear to be neo-

plastic in origin. Gall-bladder was thickened and emptied with some difficulty. There were numerous inflammatory adhesions between the gall-bladder, pylorus and stomach. These were freed. The common duct appeared about normal in size, but there was considerable edema of the tissues about it, and there were several enlarged lymph nodes. Gall-bladder was removed. Rubber dam was inserted to the cystic duct and the wound closed in layers.

Pathological Report, May 6, 1922. Specimen consists of a gall-bladder apparently unchanged in the gross. Microscopical: The section shows a definite polynuclear and round-cell interstitial infiltration of the wall.

Postoperative History. Patient did well for three days after operation, when she became drowsy and finally could not be aroused. There was rather profuse serous oozing from the wound. Reflexes exaggerated. Abdomen slightly distended, but the bowels and the urine were involuntary. Temperature, 100°; pulse, about 90.

Autopsy Report by Dr. Elser. Diagnosis: Yellow atrophy of the liver; late stage with compensatory nodular focal hyperplasia. Only the description of the liver will be given here.

The liver is much reduced in size. It measures approximately 15 x 20 x 6 cm. and weighs 600 grams. The most striking feature of the organ is the presence on the surface of tumor-like projections which vary in size and form. Some are slightly raised plateau-like elevations made of closely aggregated irregularly circular flat projections separated by narrow shallow depressions. These areas project about ½ cm. above the neighboring structure. Others present a smooth rounded surface, project from 1 to 2½ cm. above the surface of the organ, and are irregularly circular in outline. The largest nodule of this type is situated on the upper surface of the organ just to the right of the falciform ligament. It occupies an area about the size of a silver dollar and projects above the surface for a distance

of $2\frac{1}{2}$ cm. These nodules are bright greenish yellow in color and in appearance suggest a glandular structure. The intervening portions of the liver present a pale grayish pink, finely granular in appearance. The capsule of the liver is normal in thickness and presents a smooth surface. While the tumor-like portions are soft and friable the remaining portions of the liver are tough and leathery in consistence. The shape of the organ apart from the irregularities produced by the projecting masses is not much altered. It presents a knife-like anterior border which measures 1 cm. from the free margin, not more than $\frac{1}{2}$ cm. in thickness. On section the nodules referred to above are bright greenish yellow in color. The nodules present irregular but well-defined borders. The remainder of the cut surface of the organ is grayish pink in color, with a few dark hemorrhagic areas and the normal markings completely obliterated. These latter areas show no definite evidences of icterus.

The picture presented is at first sight that of a neoplasm of the liver. The extreme atrophy of the organ (which could be recognized even when only a small portion of the anterior border is visible, by the marked alteration of the anterior edge) would guard against the diagnosis of a genuine new-growth of the liver. The diagnosis at autopsy presents no difficulties. The tumefactions represent the hyperplastic remains of relatively normal liver tissue, while the remainder of the organ shows the most advanced terminal stages of a process of necrosis and complete disappearance of liver cells, with partial replacement by fibrous structures. These are the portions which should be selected for excision of tissue to be submitted to the pathologist for diagnosis. Tissues removed from the tumor-like areas will not enable the pathologist to make a diagnosis as to the exact nature of the disease. It should be borne in mind that the complete exsanguination of the organ at autopsy intensifies the differences in structure, color and form. The tumefactions in life are probably less prominent and the differences in

color between the relatively intact and the almost wholly destroyed portions of the organ are unquestionably less pronounced factors, which account for difficulties in recognizing this condition through an operative wound with only a small portion of the organ exposed to view.

Bacteriological. Aërobic and anaërobic cultures from the liver, spleen and blood of a guinea-pig injected with 1.2 cc of ground liver emulsion show growth of Bacillus coli communis.

Microscopical examination of the liver shows practically the same lesions noted in connection with the preceding case. While there are minor differences, such as more marked proliferation of bile ducts in the stroma of the hyperplastic portions of the organ and fewer islands of cells resembling liver cells in the atrophic areas, these are merely quantitative differences. (Microscopical examinations confirm the anatomic diagnosis based on gross appearances.)

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DISCUSSION

Dr. Charles H. Mayo, Rochester, Minn. (by invitation).—The paper of Drs. Pool and Bancroft, which has been presented by Dr. Pool, is of great value, as it is such reports that will advance our knowledge of the chemistry of cell function. He spoke of hyperplastic areas over the liver surrounded by connective-tissue areas. There are but two tissues of the body which have this power of hyperplasia, the liver and the thyroid gland. Two-fifths of the liver removed from each of one-

half of a litter of puppies will be regenerated and the livers of all will weigh approximately alike at the end of a year. Hyperplasia of one lobe of the thyroid often occurs with the other removed, sufficient for function. Functicn of new tissue is not always normal. The liver is affected by metallic poisons and by toxins. Such changes at death may represent the highest reparative power of the liver, and in similar patients not dying, the liver tissue returns to normal.

SURGICAL CONDITIONS OF THE RIGHT SIDE OF THE ABDOMEN, SO-CALLED CHRONIC APPENDIX

By W. F. Westmoreland, M.D.
Atlanta, Georgia

As a prelude to this paper, I wish to state that the limited time will prevent more than a sketchy outline, touching only the important points.

The results in the so-called "chronic appendix" operation have been very unsatisfactory in their terminal results. About 45 per cent of these patients do not recover from their symptoms or distress, and in 35 per cent the symptoms and conditions of the patients are actually made worse.

The distress and symptom-complex of these patients are not due to the appendix alone, but to other distortions of the ileum, cecum and colon, produced by embryonal bands. The slow recognition of this fact by the surgeon is due to small incisions, such as McBurney's (the most popular one), through which the appendix is dragged out, the meso-appendix ligated *en masse* and the wound closed, without any further examination of the abdominal contents. The small incision precludes a comprehensive view or examination of the pathology in these cases and inhibits the careful technic required in dealing with them. The mortality of the operation is increased, and the patient, if he recovers from the operation, is not relieved of his symptoms.

About twenty years ago I recognized the fact that the

appendix alone was not responsible for this condition, but was only a part of the pathology in these cases and that, without exception, the ileum, cecum or colon, usually all three, were involved, being distorted by adventitious embryonal bands and faulty development. The ileocecal fold frequently, instead of growing across to the cecum, grows downward, blending with the mesoappendix, obliterating the ileocecal fossa, pulling down and enfolding the ileum upon itself, reducing the lumen half or more and causing it to enter the cecum at an acute angle. In correcting this condition the ileum is frequently lengthened two or more inches, the lumen restored to normal and the ileum enters the cecum at a normal angle. With this condition there is always associated a distortion of the ascending colon. These distortions are caused by peritoneal bands from the parietal peritoneum, of embryonal origin, frequently from as high as the hepatic flexure, suspending and kinking the ascending colon, often preventing its proper rotation. In other cases the omentum has grown across on to the ascending colon, distoring it and occasionally producing an acute flexure at the junction of the ascending and transverse colon, by pressure almost obliterating the lumen of the colon at this point. These conditions are embryological and are produced by the complex development of the colon in its growth from the hepatic flexure downward, in which it has to rotate on its own axis, so that the ileum may enter the cecum from the left side.

Where these kinks and bands are pronounced at certain points they have taken the name of the describing author, as Lane's kinks, Jackson's veil or membrane; but usually they are not so decided and are multiple, that is, I never find this condition of the ileum without a corresponding lesion on the ascending colon. The single bands on the ascending colon produce a greater disturbance than the membranes, for I find it a working axion in abdominal surgery that a single band that produces an acute flexion causes more

decided symptoms than several bands or a wide band covering a larger area, where the angulation is not so acute.

Local symptoms, while usually present in some degree, occasionally are entirely absent, and no distress on the right side has ever been present. Those symptoms are local pain, tenderness or soreness on pressure, usually worse in the afternoon; an uncomfortable sensation of heaviness in the cecum, growing more decided as the day advances; local evidence of an accumulation of the gas in this portion of the gut, frequently held there by a spasm of the muscles of the colon. The patient is frequently conscious of a relaxation of this spasm of the gut and the passage of gas, with relief. The examiner can produce the same relief by stripping the gas out. When the gas is out of the cecum and ascending colon, the pressure, pain and tenderness in this region disappear.

Colicky appendices are the worst pain producers. Examination with a fluoroscope will not show anything wrong unless the appendix is involved. Combined with digital examination it may show that the appendix, the cecum or the colon is immovable or is not as freely movable as it should be. When the appendix is not seen at these examinations, it is retrocecal and hidden behind the barium in the cecum. The same is true when the appendix is not seen in the roentgen-ray plate. A plate taken after the cecum has passed the barium will show the appendix, or a colon injection of barium will give a good plate of the retrocecal appendix.

The general symptoms are varied—the acid stomach, pyloric spasm, digestive disturbances, a continual active infection of the intestinal tract, producing improper digestion and assimilation of the food, fermenting it and producing quantities of gas with its accompanying distress.

The most characteristic and ever-present symptom in these cases is the stress these patients have. No matter what or how much they eat, they seem to assimilate barely enough to exist at a low-grade rate. No matter what they

do or what business they are in, the effort to accomplish it is a conscious one and occasionally their efforts are futile. They seem to require as much effort to start as to perform. It matters not whether the work is mental or physical. The patient may get up feeling fine and some time during the day have a complete let-down. As he describes it, "The bottom drops out." Routine work is particularly difficult of accomplishment. An expression I have coined to describe this condition is "confusion of the brain"—that is, they require a conscious effort for mental action and the brain feels as if acting through a fog or haze. The next is the feeling of apprehension or foreboding—the "apprehensive feeling," as I call it. This produces the "apprehensive expression" most of the patients have, a fixed wrinkling or corrugation of the brows, which disappears shortly after a successful operation, sometimes within twenty-four hours. There is no other condition that produces the general stress these patients have. I have operated on these patients that have been treated for years as neurasthenics, occasionally bed-ridden, the patient making a complete recovery.

Diet and the rest-cure work wonders with these patients while they are confined to bed, but they relapse as soon as they get on their feet.

Treatment sometimes makes them feel fine temporarily, but they relapse on the same treatment. Nothing but correcting the underlying pathology gives them permanent relief, as the primary factor is purely mechanical.

Do not expect all of these cases to get well immediately; it is occasionally a year or longer before they recover, and this time should be spent under the careful attention of a physician.

The question of evolution is worthy of careful study and consideration in these cases. The feet, the female pelvic organs and the right side have never recovered from the surprise and shock of the erect position. Of the right side this is particularly true, the fact that the ascending colon

has to pump up hill what formerly emptied down hill by gravity, requires a more perfect musculate, unrestricted movement and one that is not embarrassed by kinks and restrictions of various kinds.

The colon has done the best it could,[1] in the evoluting time it has had, with the inherited materials that were on hand; but it must, nevertheless, be confessed that the result is far from that to be expected, and any additional stress that is added by developmental errors must be corrected.

That the present American diet, which is very imperfect in many ways and is acid in its reaction—an acidosis producer—plays an important part as an exciting cause and symptom producer in these cases, is certain. Just how, I am not prepared to say; possibly by the acid poisoning and intoxication of the tissue cells, particularly about the cecum, which is an acid area. Just what transition occurs in the food products as they pass into the cecum and ascending colon we do not know, but that they are of importance in the final dealing with this subject is unquestionable.

It is important to correct any coëxisting pathology at the time of operating on these cases, or, if the stress of operation is too great, make a second operation for this purpose as soon as possible. Pelvic adhesions, a retroverted uterus in the female, prostatic or urethral trouble in the male, adhesions in other portions of the abdomen, gall-stones or any condition that will produce morbid reflex neuroses will cause the symptoms to persist though the original exciting cause is removed. The abdominal muscles, which may be very lax, should be taughtened up, not by belly bands and such various devices, but by exercise.

In operating on these cases I make a straight incision over the rectus muscle about an inch to the inner side of its outer border. The rectus sheath is opened and the rectus muscle is separated from its outer border and retracted;

[1] The Human Skeleton, by H. E. Walters.

next the posterior layer of the rectus sheath and peritoneum are opened. The abdominal opening is at first made sufficiently large to easily insert the hand to examine the abdominal contents—the right hand to examine the upper abdomen and the left one to examine the pelvis.

When the operation is completed the wound is closed, layer by layer, the peritoneum with a continuous suture, the two layers of the rectus sheath and the skin with interrupted silk suture. All sutures and ligatures used are of antiseptically prepared silk. The smallest-sized strand that is consistent with the tensile strength necessary in each case is used.

Draw out from the abdomen the ileum, cecum and appendix for examination before beginning work. If the appendix is retrocecal, lengthen the incision at the top, turn the colon over and work from the outer side; this maneuver makes the work easy. Cut the mesoappendix, do not ligate it *en masse*, as this will frequently produce a distortion, particularly when the ileocecal fold grows downward and is blended with the mesoappendix. The embryonal bands are double forceped, a ligature is applied on each side and they are divided between the ligatures. Large bands enfolding the gut should be divided into smaller ones. The greatest care is exercised that the technic of handling these bands does not in itself produce constriction or angulation. I use the anterior longitudinal band of the colon as a guide and follow it up the ascending and around on to the transverse colon, looking for and correcting constricting bands, particularly at the hepatic flexure. Exercise care and separate folds and the covered-in fossa along the line of natural clevage, and frequently no raw surface is left; this is patricularly true of the ileocecal fold and fossæ.

In conclusion, I wish to emphasize that the majority of these patients are not immediately cured by operation; the mechanical faults are corrected, but the rapidity of the convalescence depends upon intelligent medical care.

All of these patients have acidosis, usually a very high grade. This acidosis is generally characterized by an acute fall and spring exacerbation, and, when an acid intoxication is present they feel like the devil. Soda should be given in sufficient dosage to control the acidosis; diet, not a restricted diet, but a well-balanced one, with plenty of green stuff, fruit, particularly ripe organes or orange juice; plenty of sunlight and fresh air, preferably taken by light exercise in the open.

The rapidity of the improvement in these cases is in proportion to the inhibition of acidosis, the well-balanced diet and the ability of the patient to take light exercise outdoors in the sunlight and fresh air.

ERRORS IN HOME TREATMENT OF APPENDICITIS

By Fred W. Bailey, M.D.
St. Louis, Mo.

The period between the initial pain and medical attendance is the period of home treatment in all cases of acute appendicitis. Unfortunately this period exists in every case and the dangers incident thereto must be minimized by good advice, that harmful errors may be omitted. The author endeavors to emphasize the usual mistakes on the part of the family or lay advisers before the physician is consulted and proper treatment instituted.

The surgeon should be as vitally interested in all measures that are directed toward preventing the development of a surgical state as he is in the mechanical correction of the same. Until surgery and medicine have exhausted every known means of preventing as well as curing injury and disease, and have applied all available scientific effort to that end, an important function will have been neglected.

It is an accepted fact that the progress witnessed in the treatment of tuberculosis and cancer has been materially aided by the coöperation of the laity. This has been accomplished chiefly through educational channels and has opened up a field of excellent promise and attractiveness. One needs but to witness the eagerness with which the lay mind accepts this educational effort to acquaint them by lecture, print, radio or any other means with truths that are vital to health, to be convinced that we have long been

negligent and have overlooked a truly important function of organized medicine.

If one has access to vital statistics covering a large community and a score of years, a vivid exhibition is seen of the great good accomplished by state, county and city health boards, Red Cross and kindred organizations in teaching the private citizen the value of preventing illness and the necessity of early attention when it has developed. Quacks and quackery, physical and mental cults, attract the eye from every angle by seductive advertising and demonstrations, and intelligent citizens by tens of thousands adopt their views and lead countless others into this pseudo-land of great promise, much to the chagrin of medical science.

Instead of placing before the public in attractive style the simple truths which will acquaint them with themselves and encourage them to saner thoughts, we attempt to discredit the influence of these cults with the least effective weapons at our disposal—sneers, ridicule or anger. Frank, free education is the latent power possessed by organized medicine which, if directed in proper channels, is so much stronger and abler than all combined antagonistic agents, that defeat for them would be certain and the health of the world enhanced thereby.

Through the combined efforts of unselfish workers, laymen and physicians, cancer and tuberculosis are being effectively influenced. The coöperation of the public is vital if we would succeed in curbing these scourges, but we should broaden our field of action by including in this educational attack other diseases which will also result in death or varying degrees of ill health if neglected or mistreated. There are many such, but the object of this attack is appendicitis. Any disease which, within a few hours, may menace life is worthy of our best effort to prevent or control. Fatal cases of appendicitis are largely preventable. If such were not true there might be some excuse for us to sit idly by, awaiting the call to cure. How much more ideal and

humanitarian the service if we but expend a portion of our energies in preventing the development of a dangerous illness, its consequent life loss or unpleasant sequelæ.

Thousands of able articles have been printed since appendicitis was recognized and classified as a disease. There is little to add that would enlighten; the operative technic has gradually improved and the ratio of fatal attacks is so low in comparison with our early attempts that we are inclined to place it upon probation as a trusty, secure in the belief that it has been thoroughly conquered. Such is not the truth; appendicitis, neglected or overtreated, is a most fatal disease. The ratio of fatalities in perforated cases is still too high, and it is in the belief that many deaths can be prevented by means at our disposal that this paper is presented for your criticism. Obviously, reference is made only to the types which progress to rupture or gangrene and peritonitis.

These few brief abstracts of recent cases coming under my care have a parallel in the practice of most surgeons and will serve to emphasize the many errors made in the early or home treatment of appendicitis.

Miss M. W., aged thirteen years. Patient arose in the morning, nine days ago, with severe cramping pains in the abdomen. Was repeatedly given cathartics by her mother, who thought her first menstrual period imminent. Food was not withheld. Several hours later the pain began to center over McBurney's point and was accompanied by nausea, vomiting and a chill. A physician was called, who advised application of iodine to the right iliac fossa, and this treatment was continued under his direction three or four days without relief, the girl being up and about in the meantime, suffering severely. A consulting physician was called, who immediately referred the case to the hospital for operation. A ruptured appendix and general peritonitis were found.

Mr. W. C. S., aged twenty-nine years. An attack of indigestion, occasioning considerable nausea, followed in a few hours by severe epigastric distress, which became generalized over the entire abdomen, localizing in the right iliac fossa. Was given castor oil and carthartic pills, but no enema. Pain and vomiting continued until the pain suddenly subsided (gangrene), to return again in a short time with marked intensity (peritonitis). Rigidity developed over the entire abdomen, accompanying rise of temperature and marked prostration. Nausea and vomiting with intense abdominal pain continued. On the fourth day cathartics were again given. Brought for operation on the sixth day. Appendix ruptured, general peritonitis and a large amount of intestinal contents in the peritoneal cavity.

Mr. E. Q., aged twenty-nine years. Nine weeks ago the patient had an attack of general abdominal pain, which later localized in the right iliac region. This was associated with vomiting and fever. Second attack occurred three weeks ago, which was similar to the attack mentioned above. Mother had given castor oil twice daily, with the patient up and about, eating regularly. Examination revealed evidence of a right inguinal abscess. Operated immediately. Large postcecal subhepatic abscess found.

Mr. R. P., aged fifteen years. Has had three similar although milder attacks. This attack started suddenly five days ago with stomach pain, which localized in a few hours at McBurney's point. Patient had been confined to bed only when forced by pain and nausea. Has had castor oil (two doses per day) to induce bowel movements. Operated on sixth day. Two abscesses found, one at the base and one at the apex of the appendix, postcecal. Appendix ruptured in two places.

Mr. C. A., aged fourteen years. This was the first time the patient had ever experienced such an attack. While

at church a sudden severe pain in the right side prevented walking or lying down. Was taken to the family doctor, who pronounced it appendicitis, put the patient to bed, gave him a hypodermic injection and advised hospital entry. Before being brought to the hospital the patient was given a large dose of castor oil by the mother. A few moments afterward had a very severe pain in the lower right abdomen, followed by symptoms of shock. Operated within fourteen hours of attack. Ruptured appendix with localized abscess.

Mr. R. R., aged sixteen years. Diffuse pain over the entire abdomen during the first two days (Wednesday to Friday), then localized in the lower right quadrant. Nausea and vomiting continued. Castor oil, two doses, given the first day. Pain in the lower right quadrant continued, tenderness to light pressure over the right abdomen. Slight rigidity of recti, most marked on the right side. Small area of dulness over McBurney's point. Pulse slow (58), full, regular in force and time. Operated on the third day. Abscess surrounding appendix.

Mr. L. W., aged twenty-nine years. General abdominal pain developed suddenly two days ago, associated with nausea and vomiting; pain later localized in the right iliac region. There was a slight rise in temperature. Had several doses of cathartics previous to attention of the physician. Operated on the third day. Appendix with abscess found.

Mr. D. J. P., aged eleven years. Generalized abdominal pain, later becoming localized in the right iliac region. In the evening of the first day a doctor was called and pronounced the case one of indigestion, and prescribed castor oil, to be repeated as indicated. Tuesday his condition was worse, pain still present. Operated on the fourth day; gangrenous appendix with general peritonitis.

Mr. L. N., aged twenty-one years. Had two attacks in the previous year of a similar nature. The present attack came on one day ago, with severe pain, accompanied by slight temperature, nausea and vomiting. Castor oil and cathartic pills given at home. Operated on the second day. The appendix was found to be ruptured at the apex, with abscess.

Mr. W. D., aged ten years. The patient was attacked with a pain in the lower right quadrant of the abdomen one week ago. This pain was accompanied by vomiting. Pain has continued since the attack. Was given cathartics each day and the diet was not restricted until the patient entered the hospital. Fluid in the abdominal cavity; the abscess was enlarged by a mass of small intestines and omentum. Cecum not involved. Appendix traced to the base of the ileoomental tumor in the midline, amputating itself on slight traction. The agglutinated bowels involved in the tumor were separated and a large abscess containing several ounces of thick, creamy, pyosanguineous fluid released.

Miss J. G., aged eleven years. Generalized abdominal pain appeared suddenly two days ago. The patient nauseated continually. The mother administered castor oil following initial pain and the following day gave another cathartic. The physician called on the third day. The patient entered on a stretcher and was operated on the third day. There was free fluid throughout the peritoneal cavity and a large postcecal abscess. Appendix was gangrenous and ruptured at the tip.

You are requested to note that not a case in the above list had failed to receive liberal catharsis. The foundation upon which most parents and some physicians treat general family ills has two main supports: the bowels must move

and strength must be maintained. Physic and food, both of which are most often guilty of serious harm. Many years ago H. O. Thomas (Ochsner, vol. iii), warned against all peristalsis-producing drugs in the treatment of intestinal obstruction. A. J. Ochsner, in his non-operative treatment of appendicitis, has applied these principles in appendicitis attacks, which he describes as "Too late for early and too early for late operation." It consists of lavage, bed-rest and nutrient enemeta, and was intended by the author to be applied when no competent surgeon was available or during the so-called second stage of an attack, that is, after pus invasion of the peritoneal cavity and before complete abscess formation by walling off had occurred.

The intent of Ochsner's treatment is ideal and many more lives would have been saved had it been carefully interpreted. The cruelty of withholding food for days and failure to attempt to remove the pain and infection by catharsis meets with but slight favor among the laity and is seldom faithfully carried out. Physicians who decry surgery except as a last resort found solace in the term "non-operative treatment for appendicitis," and applying in their practice, during all stages of the attack, such parts of it as pleased them, experienced a high mortality and brought undeserved discredit upon the most worthy effort of a master surgeon.

It is an error to divide appendicitis into definite stages with a limited time allotted to each. It is not a self-limited disease and the pathology present is so variable that the injustice of such teaching is quite evident. The so-called catarrhal type, with gradual closure of the lumen, obstructed drainage, infiltration and rupture, differs widely from the type following obstruction of the blood supply and gangrene with rupture. Previous attacks leave pathology in the form of adhesions, kinks and areas of obliteration. An acute attack, superimposed, may result in rupture and general peritonitis in a few hours instead of days. There-

fore, the error of awaiting stages and definite symptoms when immediate operation is possible. Equally imperative is the value of bed-rest and no food nor physic in all attacks whether initial or recurrent. Even when operation has succeeded in saving life, complete recovery is not always obtained and the menace of postoperative adhesions, chronic obstipation, acute ileus or a weakened abdominal wall overhang the victim or bring him again to the operating table, largely because of premedical errors which may be so readily eliminated.

It will surprise one to note how regularly, in perforated cases, careful inquiry from the patient will elicit a history of repeated catharsis. An acute perforated appendix enters a surgical service as an emergency and is ordinarily subjected to operation with as little delay as the condition warrants. There is less likelihood of a complete history being recorded than in non-emergency cases. A brief routine, history, careful physical and laboratory tests of blood and urine usually establish the diagnosis and, unless one is careful to obtain specifically the premedical treatment, it is overlooked. This has been found true in our local hospitals and in the experience of our leading surgeons.

In a series of over 75 cases of ruptured appendix, coming under the surgical service at St. John's Hospital within the last two years, over 93 per cent have given a history of catharsis by the family or physician, or both, administered from one to ten times, all types of purgatives being used, with castor oil in the lead, ranging from salines to pituitrin and croton oil. The more severe the attack, especially if complicated by toxic ileus or mechanical obstruction, the more determined and persistent the effort to rid the intestinal tract of the disease by purgation. Violent vomiting has often defeated the effort, but naturally has not quieted peristalsis.

Dr. Judd, from the Mayo Clinic, informs me that in a series of 139 cases of acute perforated appendicitis operated

within three and a half years a definite history of purgation was obtained in over 37 per cent. He expresses the impression that a large number of the remainder had received cathartics before entering the Clinic, of which no record was elicited.

Dean Lewis reports that preliminary catharsis is rare in the ruptured cases at the Presbyterian Hospital, but that such strong emphasis has been laid upon delayed operation for appendicitis that perforated cases are seldom received, only a few hours elapsing between the attack and operation.

From the Jackson Clinic in Madison, Wis., it is reported that, as a result of a rather intensive educational campaign in their vicinity, which has been conducted for the past twenty years, a marked decrease in cases of ruptured appendicitis is noted, but that fifteen years ago at least 50 per cent were recorded as having been purged before operation.

These reports show the undoubted value of educational publicity. Familiarity with small town hospital records will demonstrate that many of the desperately ill are being operated there instead of in the cities.

As noted above, among the laity, pain or cramps in the abdomen have from time immemorial been treated by purgatives. For a certain group of abdominal complaints, not inflammatory in character, hasty elimination is indicated; for another and more serious group it is harmful in the extreme. If one is likely to err, it had best be on the side of safety, for if the ailment is insignificant, conservative treatment will not harm. Until medical advice is available, all cases of acute abdominal discomfort with nausea or vomiting, therefore, should be treated for the first few hours in the home as if it were the beginning of a serious affection. Errors will oftentimes be made and brief loss of time may result, but lives will be saved and slight inconvenience to many thereby justified.

Abdominal pain may indicate one of many conditions.

The laity cannot be expected to diagnose the ailment, but if they can be taught to do no harm and let a competent interpreter point the way much anguish will be saved. It is up to us to furnish that competence. It is intended herein but to direct attention to a few simple suggestions, the observation of which will conserve life and, in those cases which progress to operation, greatly shorten the period of hospitalization and reduce postoperative complications to the minimum.

Within the last ten years careful note has been made of the preoperative treatment of each case of acute appendicitis that has come under my care. At least 90 per cent of those in which an abscess developed had at some time during the attack, before reaching the surgeon, been given generously of laxatives and cathartics. I believe this experience can be substantiated by most members of this society. Urged, no doubt, by the old teaching that strength must be maintained in illness, in most perforated cases food has been insisted upon and bed-rest observed only when nausea, pain and temperature made it mandatory. There is but a narrow margin between the sane and the insane care of a threatening appendicitis, whether due to stricture or angulation and obstruction of the lumen or circulatory obstruction from any source. If the forces of Nature are to overcome or ameliorate the attack, rest is imperative. Complete physiological rest alone will furnish this opportunity. This includes starvation, that peristalsis may become and remain quiet; absolute bed-rest; and the avoidance of all intestinal irritation, such fluids and nutrients as are needed being administered as small, low enemata. To one who at the operating table has observed the profuse variety of pathological states in which the appendix may become entangled, it is not difficult to become impressed by the ease and rapidity with which an almost invisible pathology may, when abused, become a relentless executioner. Argument is not needed to prove that an obstructed appendix

with a thrombosed blood supply cannot be cured by intense and repeated intestinal irritation. And yet we have failed to effectively warn the laity and remind unthinking physicians of the dangers that the application of a few simple suggestions would probably avert. If we should suggest some particular drug for appendicitis and advertise it in the press no home would be without it. It is equally as reasonable to believe that any mother, if informed by her physician, in whom she has confidence, that persistent abdominal distress accompanied by nausea or vomiting, regardless of dietetic errors, is a signal for—

1. Bed-rest,
2. The physician,
3. No food or medicine by mouth,

that she would be grateful for the advice. If all families were thus informed through the medium of the press, sponsored not by a physician or surgeon of established reputation, as is the custom, but by the American College of Surgeons, the American Medical Association and the local medical societies in each community, and the warning accompanied by a brief explanation of the motive, I can but believe that it would effectively lessen the number of virulent cases of appendicitis and result in great good to all concerned. From Davenport, Iows, the home of the chiropractic, a powerful radio persistently broadcasts their teachings throughout the country. How long must it be before organized medicine will see fit to relax her dignity and bend her back to further the interest of the health of the people by broad-gauged, properly sponsored publicity?

Conclusions. 1. The virulence of appendicitis is not decreasing. It is because of the fact that careless, indifferent treatment obtains.

2. Many forms of appendicular colic, that are lashed into a fulminating process by purgatives, would recover from the immediate attack if sanely treated and could then be operated without mortality. Until we know the exact

pathology present in each case, we cannot hope to pronosticate the outcome. Such knowledge is impossible.

3. The interval operation is a misnomer. The time to operate is at the earliest moment of positive diagnosis, provided talent is available and the environment acceptable. As soon as careful examination has eliminated other neighboring diseases, removal of the affected appendix is indicated. If the process is acute and progressive and the patient's resistance low, release of the pent-up pus through a gridiron exposure, under local anesthesia, is without shock and the surest method of reëstablishing normal resistance.

4. Is it not feasible, through unselfish motives and non-advertising channels, to impress the public particularly with these few facts and suggestions?

(*a*) Abdominal pain, whether or not attended by nausea or vomiting is a danger sign and should be treated with due respect. It may indicate anything from a simple colic to impending death.

(*b*) The most effective premedical or home treatment includes:

(1) Immediate and complete bed-rest.

(2) Nothing by mouth, that peristalsis may remain inactive; positively no cathartic of any sort.

(3) If, within a few hours, this treatment aided by a small low enema has not secured relief, transfer the responsibility to a physician.

In view of the fact that errors in the early care of an acute attack are not always committed by the family or friends, it is not unwise to remind ourselves as physicians, that:

(*a*) Only small enemata for the immediate relief of gas pain and contents of the lower bowel may be given with comparative safety;

(*b*) No morphine or other sedatives should be administered until the diagnosis is certain;

(*c*) The ice-bag exerts but little beneficent influence, aside from a slight degree of mental satisfaction that something is being done. Relief of pain may follow, but is often the cause of fatal delay and does not indicate that the patient is improving. The ice-bag also possesses the disadvantage of rendering the skin and subcutaneous structures less resistant to infection if operation follows;

(*d*) The pulse, temperature and blood picture are insignificant if other clinical signs point to a definite attack. Especially is this true if the patient is seen when profoundly toxic and the resistance decreasing;

(*e*) It is not wise to await the interval. The time to operate in every acutely progressive attack of appendicitis is as soon as diagnosed, all other possibilities eliminated and competent service at hand.

DISCUSSION ON THE PAPERS OF DRS. WESTMORELAND AND BAILEY

Dr. Charles R. Robins, Richmond, Va.—I am not going to bore you with a discussion of the subject of appendicitis, except in so far as to call your attention to a few facts that have recently been brought to my attention in our section of the country.

Appendicitis has been discussed so much that we feel we know all about it, and when we hear a paper on appendicitis we simply close our minds and say, We know all about that subject, at any rate.

Now, the matter of statistics is one of the very interesting things about appendicitis. If you ask the average surgeon about the statistics of appendicitis operations, he will have in mind the figures that have been published by surgeons of repute, and he will invariably tell you that the mortality from appendicitis at most is about 0.5 of 1 per cent. They may be getting it down a little lower, but they do not refer to their own statistics—they refer to those that are published. The

point I want to call attention to is that the real statistics to be consulted are the United States reports of deaths.

Since 1912, there has been a steadily mounting death-rate from appendicitis and peritonitis, and the death-rate since 1912 has gone up 22 per cent, which means that somebody is losing cases of appendicitis.

The other point I want to make is that there has been a great tendency among the internists to tell surgeons when and how to operate. There is hardly a subject that has been taken up by surgeons that is not reviewed with more or less skepticism by medical men. It is often said that every surgical case should be reviewed by an internist before an operation is undertaken. This is certainly along the right line, but at the same time I do not believe that a surgeon should always give way to a medical man in matters of diagnosis. There are certain types of cases in which the surgeon is better able to make a diagnosis than anyone else, and this is particularly true of appendicitis. Who is in a better position to make a differential diagnosis of the acute abdomen than the surgeon? But the principal point is that promptness is the greatest factor in securing a low mortality and delay is the most dangerous thing. It is of such vital importance that in cases of doubt it is safer to operate than to delay. Occasionally an appendix may be removed unnecessarily, and occasionally the case may be one of stone in the ureter; but if we want to get good statistics in appendicitis, we have got to operate promptly, and in a way occasionally take a sporting chance.

Dr. Charles H. Mayo, Rochester, Minn.—The paper of Dr. Bailey is an important one, as it deals with the fundamental principles of surgery and indicates our lack of educating the public concerning disease. We have raised our own educational fence for the profession so high that beneath it are creeping all kinds of cults, and the partially educated who mentally and educationally are in closer touch with the people than we are. I would suggest that this Association offer to help the local health boards of any city in which we meet and from our group can be selected three or four speakers to address a public meeting on cancer and preventive medicine and medical topics of popular interest.

Dr. John T. Moore, Houston, Texas.—As students we were taught a great deal about the methods of treating appendicitis.

The various treatments have been thoroughly ground into the medical profession throughout the country. I refer to the drip method of one of our distinguished Fellows, in one of the great cities of this country. As a result of this teaching, the average doctor thinks appendicitis ought to be treated that way. A great deal of harm has resulted from following this teaching. The profession has spent much time in discussing the value of this method of treating appendicitis. Now we look upon the appendix as an organ for early operation, the sooner the better. There needs to be missionary propaganda throughout the length and breadth of this country to teach the profession their duty in these cases. I mean the average doctor, who sees these cases before the trained surgeons see them, needs to get out from under the "smoke cloud" of the teaching concerning the treatment of appendicitis by waiting for a safe time to operate.

As a professional body, we are responsible for this old fetish of giving medicines when we see a patient—in other words, purges. The average doctor does just what was illustrated by a prominent man in our city who said to his wife: "Why send for a doctor; we can do just what he will do. There are two things you need to have in the house, one is a purge and the other is quinine. We can give our boys a purge and then can follow that with quinine." The average doctor when he sees a patient who has cramps in the abdomen, gives him a purge. Nature has already tried to offer protection by stopping the movements of his bowels. We are responsible for teaching that nonsense. We do not need a paper of this type for our own education in this matter, but we need to go out into the communities and talk about these things to the average members of the profession so that we will not see these cases of perforation caused by purges. Such a paper does much good in educating both the laity and the doctors.

As suggested by Dr. Mayo, there ought to be public meetings held so that the people may become better informed in handling acute abdominal conditions. That is, they must be kept from doing harmful things, as in giving purges, before the doctor arrives.

Dr. J. Garland Sherrill, Louisville, Ky.—At the Birmingham meeting of this Association, a number of years ago, I presented a paper on the subject of "Perforative Peritonitis

Due to Rupture of the Appendix." We had a love-feast confession. A number of the members at that time acknowledged they had been mistaken about certain contentions, and we thought we had crystallized practically the treatment of this affection throughout the United States. It is hardly necessary to speak of the danger of purgation in these cases. If each of us will carry home the message Dr. Mayo has given us, our own mortality will be lessened by teaching the men who are sending us cases of appendicitis for operation. If we teach the general practitioner that purgation is dangerous, this will help us in reducing our own mortality. When you get that into their heads, you will find it of great benefit in lessening the number of deaths from appendicitis throughout the United States.

The general medical profession of the country is going through in the treatment of disease what this Association went through a few years ago. A number of men in this country beginning the practice of surgery are yet doing general practice and are going through the stage we went through years ago, and that accounts, to some extent, for the increased mortality in the country mentioned by Dr. Robins. They have learned at the expense of their clientéle, but if you will teach the people not to give purges but send for a doctor, I feel we will accomplish a great deal. The profession of the United States knows that a patient with appendicitis should not have purgatives, because they are dangerous. After operation we all know the value of washing out the stomach. Ochsner did great good with his work. If a patient cannot get to a surgeon and cannot be operated on, the physician should wash out the stomach, prop the patient up according to Fowler's method and operate whenever the patient is in a condition to withstand it.

Dr. Frank C. Beall, Fort Worth, Texas.—In regard to the education of the public, it is well enough to speak at public meetings and present facts to the people which we know. We know the harmfulness of cathartics in acute abdominal conditions, but we do not get to the people to whom we wish to convey our information. It is not the doctor who reads medical journals that needs instruction and needs a warning about the use of purgatives. The surgeon ultimately gets these cases of appendicitis for operation, but too often he gets them in the advanced stage. If we would not hold back in discussing these cases with the men who refer them for fear of hurting

their feelings, and educate the patient's families and educate the doctors who still use purgatives and opiates, we would get to the right place.

Dr. E. P. Hogan, Birmingham, Ala.—The paper of Dr. Westmoreland was interesting. There are postoperative conditions in the right side of the abdomen which remind one of preoperative conditions reported by Dr. Westmoreland. There are postoperative conditions, with adhesions frequently, which interfere with the emptying of the bowel, and a large cecum, which may be a continual annoyance to the patient, but if operated on, removing the adhesions, will give complete relief.

While the paper of Dr. Bailey is interesting, it would have been much better if it had been presented before general practitioners rather than the members of this Association. I agree that what he has said will serve to emphasize certain points we have in our minds.

It occurs to me the title of his paper, "The Home Treatment for Appendicitis," is dangerous. It would seem to me if the title were changed to a condemnation of the home treatment of appendicitis it would be very much better, for the reason that someone will take this title and use it to a great disadvantage.

I know a doctor, who is a graduate of medicine, who advertises to get patients, because he says he could not make a living otherwise. He advertises that he treats patients with appendicitis and gets them well without operation. His own son was stricken with appendicitis and my brother and I were called in and operated on him. While he advertises he can cure cases of appendicitis without operation, yet when his own son was stricken with the disease he called in a surgeon to operate.

I do not think there is any home treatment for appendicitis. A patient with appendicitis should be sent to a hospital at once and operated. Of course, it goes without saying that the diagnosis ought to be made. We should educate the general practitioner that no morphine should be given.

I have seen three patients with appendicitis recently who demanded relief with morphine. I gave no morphine. One man said, "Are you not going to relieve me?" I replied, "Unless you let me call an ambulance and send you to the hospital I will give you no relief whatever."

Another young man from the army said: "Doctor, I have had the best men in the army look me over. I have had these attacks in the army, and if they were attacks of appendicitis they would have operated on me." I replied: "I cannot help what you say; you have appendicitis, you must go to the hospital. If you do not, I am going to be relieved of the responsibility in your case." He did not go to the hospital; he stayed in his room and was treated by someone else, and within a week's time was carried home to Newton, Alabama, a corpse. His mother and sister came to my office with black crape on and told me how sorry they were that this man did not take my advice.

I also saw a similar case recently, in a young man who, while at work at his father's place of business, had an acute attack of appendicitis, refused to go to the hospital as urged by me, but went home, in the western section of our city, was given the so-called "home treatment" for appendicitis, and in three days after general peritonitis had set up, finally consented to go to the hospital. His mother came into my office a short time after, in crape and in deep sorrow, and told me how sorry she was that the young man did not take my advice and let me operate on him at once. A surgeon, a friend of mine, in the western section of the city, operated on this moribund case, and I feel sure that he did the best that could be done for the case. The giving of morphine and the consequent postponement of operation caused the death in this case.

I believe the right thing to do is to take the position that there is no home treatment for appendicitis, and that patients when they are stricken with this disease should go to a hospital and be operated.

Dr. William E. Lower, Cleveland, Ohio.—People have not failed to keep faith with us when we have been teaching them about appendicitis, but there is another point in the case which I would like to bring out: I think the public is rather eager to seize upon everything we may suggest which is liable to prevent a catastrophe, but one thing that makes them a little shy perhaps in bringing cases to us, is the fact that so many cases have been operated on which were not appendicitis at all—the so-called chronic cases—in which the only complaint suggesting appendicitis was a pain in the side. Thirty per cent of the cases operated on for appendicitis have

been reoperated on for stone. If we continue to make mistakes, patients will lose faith in what we tell them. It is, therefore, important that we lay more stress upon the diagnosis in chronic cases, and that we do not remove the appendix of every patient with a pain in the right side unless the diagnosis of appendicitis is certain.

Regarding the propaganda for cancer, it has done great good, for the reason that people with tumors of the breast have been reporting to doctors early, but if every tumor of the breast means a mutilating operation, patients will not keep faith with us. In the same way we must guard against making mistakes in the diagnosis of the so-called chronic cases of appendicitis.

I think Dr. Bailey's title is wrong. There is no home treatment for appendicitis, and if the impression goes out from this Association that there is a home treatment for appendicitis, it would do great harm, for the laity would feel they can treat their own cases.

Dr. Westmoreland (closing on his part).—I am sorry the two papers were not on acute appendicitis, so that they could come together. But each one is as separate and distinct as any two surgical cases could be. The acute appendix is one thing and the so-called chronic appendix is another. The fact that a man has had appendicitis and is not operated on does not correct the right-sided condition. The right-sided condition cannot be corrected in acute cases without increasing the mortality materially.

I recall a patient with an acute appendix, and the surgeon said to the patient, "What time tomorrow will you be operated on?" The patient replied, "You can operate on me tonight before you go to sleep." He was operated on two or three hours after the attack was recognized and fecal concretions were found, one of which had eroded through the appendix. If we had waited until the next day the appendix would have ruptured.

With all due respect to the mortality, it depends to a great extent upon the character of the infection present in the appendix when operated on. If it is a certain type, even though perforated, with symptoms more or less of peritonitis, the patient will recover.

My own personal feeling in handling these cases is that they

ought to be operated on at once, or they must get another doctor. The fact that they are not all operated on is a mistake, because many of these patients have an increased security by recovering from one or two attacks and die from the false security established. I know quite a number of cases where that has occurred. The condition I am speaking of is one that is not affected by the appendix except incidentally. I was calling attention to the fact that in this day surgery should not be left in the position it was years ago, recovery from operation; but does the patient recover from the symptoms he is suffering? General practitioners say that these patients come back complaining that they were operated on and are now in a worse fix than they were before operation. In these cases the appendix was removed, but the associated bands around the ileum, cecum, and colon were not cleaned up all the way, and I am gradually coming to the conclusion that acute angulations of the upper part of the colon are greater symptom-producers than the conditions around the lower part of the colon or the cecum. If the incision is not sufficiently large to examine them and correct them, the patient will not be relieved by operation. Surgery is not successful if the symptoms for which the operation was done are not relieved.

Dr. Bailey (closing).—I wish to thank the gentlemen for their generous discussion. If I had had time to finish my paper, most of the points that were brought out would have been discussed.

Dr. Mayo sounded the keynote when he suggested that reading a paper of this sort here was somewhat out of place; that the public should receive it direct. It was not my intention to attempt to instruct the members of this body, but to interest them sufficiently to get at least a slight impetus toward the development of some plan whereby this warning can be included with other types of general instruction and thus reach the public and physicians as well. The physician must first be reminded through his daily contact with the laity; with the help of printed propaganda, legitimately supervised, the gospel can be spread. Idealism in medicine or surgery must be constantly striven for. If that state is ever to be approached, the coöperation of the entire public must be obtained by broad-gauged instruction. At present, we can aid by informing them how they can refrain from harmful home treatment.

The title of my paper was erroneously printed. It should read "Errors in Home Treatment for Appendicitis." This title must stand, as there is a certain stage of home treatment in every case, and in that short interval before people become frightened and send for a physician, they are liable to do most harm. The treatment should be bed rest, no food or medicine by mouth and a physician.

All of you who have radio outfits know quite well the activity of the chiropractors at Davenport, Iowa, who are daily broadcasting throughout the country their nefarious propaganda. It is not detrimental to the dignity of our profession to do likewise, or to resort to any legitimate medium, that needful information may be spread. We should educate the public and prevent them from doing harm, as well as instruct physicians themselves, so that they will do no harm; and if we will each of us bend our energies earnestly to the tilling of the field of prevention, by early care and timely operation of conditions which later may become a life menace, medicine and surgery will make a rapid and wholesome advance to the confusion of harmful schools of healing.

MY APPENDICITIS MISTAKES

By Robert T. Morris, M.D.
New York, N. Y.

(Read by Title)

In at the beginning of appendicitis work in our profession, I have enjoyed the privilege of observing all of the evolutionary changes to date.

In the early '80's surgeons merely opened the abscesses of acute appendicitis. There was still general fear of the peritoneum and there was considerable literature devoted to methods for opening appendicitis abscesses without opening the peritoneal cavity. It was customary to apply local applications and not operate until pus had appeared. When the classical paper of Dr. Fitz appeared, in 1886, we all began to plan for the removal of infected appendices as soon as the diagnosis had been made.

At that time methods of the third or pathological era in surgery were getting well under way. Surgeons were impressed with the idea that bacteria and their products must be destroyed by actual germicides. The protective forces of the individual were not taken into consideration very seriously. The surgeon was supposed to take the place of Nature, and this he did in an attitude of superiority over Nature.

My mistakes at this time consisted in falling in line with accepted methods of procedure. Large incisions were made conscientiously in the idea of getting all of the pathology

of the case in sight. I employed germicidal solutions for flushing out septic by-products of bacterial action and employed shock-producing procedures for the separation of adhesions, removal of adherent coagula and sometimes of thickened, discolored portions of ragged omentum. Gauze pads were employed for preventing purulent material from getting upon uninfected peritoneum during the course of operative work. After the operation extensive drainage methods were employed, sometimes including the open packing of wounds with iodoform gauze.

Furthermore, acting with a feeling of security given by newer methods of anesthesia, I operated without particular thought of speed, and in fact felt that thoroughness in application of detail stood first in importance. Every single one of these steps had a special death-rate of its own, as we have now come to know in our appreciation of the principles of the fourth or physiological era of surgery, in which the surgeon is to turn the patient over to his own natural resources in the simplest and quickest way that is feasible in any given case. The long incision which I made for the purpose of obtaining a view of all of the pathology in the case gave me a view of a field full of wrong impressions. The old-fashioned practitioner who refused to have his appendicitis patients operated upon because he wore blinders, which prevented him from seeing all of this pathology, had about as good results as many of us had with our early operative work. A famous Chicago surgeon at that time reported upon a list of fourteen consecutive deaths following operation upon acute appendicitis patients. He expressed the opinion that operation should not be done excepting in the interval stage. The application of actual germicides did not have quite so direct a death-rate of its own, but it meant the injury of normal protective cells which were destroyed along with the bacteria. The application of extensive drainage devices and of gauze packing caused shock which could not have been borne by some of the patients if they had had

no appendicitis at all. Later, I described this as committing taxidermy upon appendicitis patients. Surgeons sometimes had to give a patient an anesthetic in order to remove the gauze packing that had become adherent to various structures within the abdomen. When iodoform gauze was used the symptoms of iodoform poisoning were so much like those of general sepsis that patients sometimes failed, day by day, from iodoform poisoning mistaken for unavoidable sepsis. Wounds packed openly were practically certain to give us hernias later, requiring subsequent operation. Insistence upon separation of adhesions for the purpose of removal of infected or gangrenous appendices was all wrong. It had its own death-rate, belonging to the shock of a procedure that was ill-timed unless such appendices were right at hand and could be removed without much manipulation.

The mistake of employing gauze pads for preventing the spreading of purulent material to uninfected peritoneum lay in a wrong conception of the great normal response to infection which patients really call out in the vicinity of an infected area.

Little by little the significance of various mistakes appeared. At the present time I operate as deftly and rapidly as possible through short incisions, employing the simplest of drainage devices and taking no pains to remove all of the pus, infected material or "difficult" appendices.

During the third-surgical-era part of my work the death-rate due to technical mistakes was large; but after moving up to the principles of the fourth or physiological era it became possible to have a run of more than fifty consecutive operations in cases of acute appendicitis with various complications without having a single death and with almost no postoperative hernias.

The Ochsner starvation method of treatment of acute appendicitis which brought such a storm of disapproval and misconception at the time of its promulgation was really based upon principles belonging to advanced method,

of the fourth era of surgery. My latest operative methods with discarding of so many mistakes of the past, seem to mean little more than an extension of the Ochsner idea carried beyond the point of approval on the part of that author himself.

In the early history of the subject I made a good many mistakes relating to chronic appendicitis. Sometimes at operation an appendix which was the seat of chronic infection was found. These patients usually gave a history of previous acute attacks of different degrees of severity. Sometimes there was no appendicitis at all, and I found tubal disease, pelvic adhesions or conditions belonging to so-called vagotonia. Operations in the latter class of cases were particularly wrong.

Once in a while I found a case of tuberculosis of the appendix or of the bowel in the vicinity, or the less common diverticulitis. More often, in cases which were diagnosticated as chronic appendicitis, fibroid degeneration was found. Lymphoid congestion or simple congestive condition belonging to enteroptosis was found in many patients of the neurasthenic group. The first one of these conditions, fibroid degeneration, I later came to believe represented a normal involution process. It had been a mistake to advise these patients that they were in danger from an acute attack. It is quite true that digestive disturbances were sometimes dependent upon irritation of the innervation of the gastroenteric tract as the result of pinching of nerve filaments in fibroid appendices, during the normal course of connective-tissue contraction. The largest number of mistakes was made in connection with removal of appendices which were simply congested along with congestion of other viscera in some phases of enteroptosis. Here is where unsatisfactory appendicitis cases made their appearance on the whole. At that time we did not have, or at least I did not have, good methods of diagnosis for chronic appendicitis, even along lines of "methods of exclusion." Later on it was observed

that a new point in diagnosis relating to chronic appendicitis was quite as valuable as McBurney's point in the acute cases. In chronic appendicitis the constant nagging finally seems to result in chronic hyperesthesia of the second or third sympathetic lumbar ganglia of the right side, known by anatomists as the fused ganglion. Deep pressure upon the abdominal wall, about an inch and a half to the right of the navel and a trifle below, brought out the special tenderness of the fused ganglion of that side. This point in diagnosis of chronic appendicitis became extremely valuable for differential purposes. (It does not belong to acute appendicitis.) Another diagnostic point, nearly as important, consisted of a chronic distention of the ascending colon with gas. This appeared to be due to the tiring out or wearying of the innervation of the cecum and ascending colon following the constant nagging of an irritating appendix, and appendix representing an irritative lesion rather than an infective one. This permanent distention of the ascending colon gave a percussion note that I call "the cider-barrel sign." The reason for giving it that name was that percussion upon the left side of the abdomen usually gave a normal resonance suggestive of the cider-barrel in October, while percussion upon the right side of the abdomen gave a note suggestive of the cider-barrel in March.

Armed with these two factors in diagnosis, the point of hyperesthesia of the fused ganglion of the right side and the cider-barrel sign, it became possible to rule out all sorts of confusing conditions which had previously led to the making of mistakes in diagnosis of chronic appendicitis. A rapid accumulation of knowledge made by many authorities on the subject of vagotonia and various phases of enteroptosis allowed me to avoid operation and to advise medical treatment in many cases in which I had formerly operated.

MESENTERIC THROMBOSIS

By James F. Mitchell, M.D.
Washington, D. C.

While mesenteric thrombosis, or, as it might more properly be called, mesenteric vascular occlusion, cannot be classed as a surgical rarity or curiosity, it may certainly be considered one of the most serious abdominal catastrophes with which the surgeon has to deal. Some 500 cases have been reported, and these undoubtedly represent but a small proportion of the actual number. My own personal experience is limited to 4, of which the last, presenting unusual difficulties and resulting in recovery, seems worth discussing and recording.

The patient, a previously healthy, athletic girl, aged twenty years, was seen on August 13, 1921. Except for some indefinite digestive disturbances and a mild anemia there was no history of past trouble. The note states that yesterday she climbed a mountain; otherwise there was no history of trauma or any unusual exertion. This morning she went shopping, came home, ate her lunch and about two o'clock was seized suddenly with violent epigastric pain. The pain continued throughout the afternoon and grew worse. It has been constant and not crampy. She has vomited frequently. She has been given soda, brandy and other household remedies, all of which she vomited.

Examination about eight o'clock at night shows the patient looking distressed and complaining of violent epigastric pain and nausea. The pulse is 72 and the temperature 98.2°. The abdomen is natural looking, respira-

tory movements present and everywhere free. There is no distention or fulness. On palpation there is nowhere tenderness or rigidity, and no mass can be felt. An enema resulted in a good normal movement, with solid fecal matter and gas, giving considerable relief. The leukocyte count at 9 P.M. was 21,000. The condition at this time suggested the possibility of a mild acute appendicitis, although the leukocyte count seemed high. At midnight the temperature was 98.2° and the pulse 72. There seemed no indication for immediate interference. She was therefore given $\frac{1}{8}$ grain of morphine and all food by mouth prohibited.

August 14, 1921. She had a very comfortable night, slept some and has had no further vomiting. At eight o'clock this morning her temperature was 98.2° and the pulse 72. The abdomen seemed a trifle full, but there was still no rigidity and no tenderness. In the suprapubic region there was a distinct feeling as of something filling the pelvis, but there was no dulness on percussion, no tenderness and no rigidity. At ten o'clock the leukocyte count was 21,000 and her condition about the same. At noon, although the temperature was still normal, her pulse had risen to between 110 and 120. The abdominal condition was unchanged. She still had constant epigastric pain, but no nausea and no vomiting. The condition suggested some grave intra-abdominal lesion, not inflammatory, and while a circulatory disturbance was considered, it was rather felt to be an ovarian cyst with twisted pedicle. The rising pulse with a suggestion of shock made further delay seem unwise, and she was taken to the hospital for operation, which was finally done at 3 P.M., about twenty-four hours after onset. The patient took her anesthetic well and went to sleep quickly, requiring very little ether. Her pulse was 120 when she was placed upon the table. The incision was about to be made, when she suddenly stopped breathing. The pulse was imperceptible, pupils widely dilated, and she was deeply cyanosed. Artificial respiration was given

for several minutes before there was any voluntary breathing. Her color improved as her breathing became better, but the pulse remained exceedingly rapid, and she was beginning to move on the table. On placing the ether cone over her face to resume the anesthetic, she again stopped breathing and artificial respiration was again necessary. The pulse as nearly as could be counted at this time was 180. She was stimulated and given salt solution subcutaneously, and without any further anesthetic an incision was made from the umbilicus to the pubes, her movements being restrained by nurses holding the hands and feet. The ether cone was never placed over her face for the remainder of the operation, a few drops of ether being administered from time to time through a piece of gauze when her struggles became too violent, and throughout the whole operation less than a quarter of a pound of ether was used. Immediately upon opening the abdomen there escaped a great quantity of bloody fluid and there presented a large black coil of small intestine about 7 cm. in diameter, lying just above the pubes. The incision was enlarged to the left of the navel, as it was evident that room would be required, and retraction was impossible because of the lack of relaxation of the abdominal muscles. The coil of intestine was delivered and was found to consist of eighteen inches of ileum, extending from the ileocecal valve upward. The appendix was not involved in the process and appeared normal. The mesentery corresponding to the involved coil was very thick, edematous and infiltrated with blood. No pulsation could be felt in the mesenteric vessels. The serosa over the coil was cracked in places, suggesting impending perforation, and the bowel was filled with fluid and gas. In spite of the bad condition of the patient, it was evident that the only possible chance lay in immediate resection. There was no evidence of any twist or obstruction in the mesentery, and the line of demarcation was sharply drawn at both extremities of the coil, the involved area

extending exactly to the ileocecal junction. A crushing clamp was placed across the end of the cecum about one inch beyond the lower limit of gangrene and another on the ileum at the same distance above the upper limit and linen ligatures were rapidly tied in the crushed areas. The bowel was burned across with a cautery between the ligatures and clamps, the mesentery ligated with catgut and the whole involved coil removed. The ends of the cecum and small intestine were turned in first with a purse-string suture of linen and secondly with a similar one of chromic catgut. A lateral anastomosis was made with an outer stitch of linen and an inner one of chromic catgut. The omentum was turned down over the anastomosis and the abdomen closed. A gauze and rubber cigarette was left in the lower angle of the wound extending to the peritoneum. The patient was in extreme condition at the end of the operation, which, with its various interruptions, had consumed nearly two hours. Her pulse was about 180 and she was in marked shock. She reacted quickly, but was in rather serious condition for forty-eight hours. Her wound healed *per primam* and she made a rapid recovery, and was walking in three weeks. She is now, December, 1922, in excellent health and the only noticeable effect of the operation is that she has been inclined to have several movements daily, a condition which has been somewhat controlled by the administration of bismuth. A recent roentgen-ray examination of the alimentary canal shows no abnormality and nothing to indicate any changed relations. It was thought that the frequent movements might be due to an unusually large opening between the ileum and the cecum, allowing the fluid contents of the ileum to pass on too rapidly. However, Dr. Christie, who made the fluoroscopic examination, reports that the bismuth meal progresses throughout at the ordinary rate.

This case presents several points of interest which will be taken up in the general discussion of the subject.

Mesenteric thrombosis is of particular interest because of its gravity, the difficulty of diagnosis and the poor results of surgical treatment. Pathologically, the occlusion may be either venous or arterial, or both vessels may be involved. Venous occlusion is less dangerous than arterial and is less frequent, occurring in about 40 per cent of cases. It is due, in most instances, to a descending thrombosis, or may be in itself a primary affair, due to some infectious process in the intestine, most often appendicitis. Arterial occlusion, occurring in about 60 per cent of cases, is usually attributed to arteriosclerosis, endocarditis or to some infectious process elsewhere. This explanation will answer for those cases where the catastrophe occurs in the course of or following some infection or surgical condition. There are many instances, however, where no explanation can be given for the source of the embolus which has caused the obstruction. Such was the case under consideration, for the patient had no history of infection or trauma or any other condition which might explain the liberation of an embolus. As a matter of fact, the majority of cases which come into the hands of the surgeon are of this type, and this fact possibly offers a partial excuse for the extreme infrequency of a preoperative diagnosis. The superior mesenteric artery is occluded more frequently than the inferior, the usual explanation being that its diameter is nearly three times as great as that of the inferior; that it arises from the aorta at a higher point than the inferior, thus having an earlier opportunity of intercepting an embolus; and that its course is nearly parallel to that of the aorta, while the inferior runs off at an acute angle. The result of the occlusion is usually a hemorrhagic infarct, a pathological condition which has never been satisfactorily explained, except that while the superior mesenteric artery is not anatomically a terminal or end-artery, it nevertheless is so physiologically. Ischemic infarction is extremely rare. The amount of bowel involved depends upon the location of the occlusion. The terminal

portion of the ileum is supplied by a single branch of the ileocolic artery, an area which about corresponds to the involvement in our case. The loop of bowel supplied by the occluded vessel becomes engorged with blood, appearing greatly thickened and distended with gas and fluid. Peristalsis is decreased or entirely absent and there exists practically a paralytic ileus. Untreated, the condition goes on to gangrene and perforation, unless the area is extremely small, when circulation may be reëstablished, a condition which probably occurs much oftener than is suspected after abdominal operations. The mesentery becomes edematous and infiltrated with blood to such an extent as to interfere with motility of the intestine. This was most striking in the case under discussion, the mesentery being 2 or 3 cm. in thickness.

The early symptoms of mesenteric thrombosis are practically those of any intra-abdominal catastrophe. They vary according to whether the case is a primary fulminating one or of the secondary type, appearing as a complication of preëxisting disease. Pain of sudden onset, severe and agonizing, is the most striking and the earliest symptom. Its location varies according to the point of occlusion or it may be generalized throughout the abdomen. It is most often about the navel or in the epigastrium. It has been explained as being due to dragging on the mesentery from excessive peristalsis caused by obstruction in the affected loop. In our case, through long periods of observation, no peristalsis could be made out even by careful auscultation with the stethoscope over the abdomen. It seems to me that a better explanation is that it is due to distention and edema of the mesentery, which we know to be so highly sensitive. In our case the pain was also constant, which would not be the case were it caused by peristalsis. It may be compared to the steady pain of an appendicitis due to infiltration of the appendicular mesentery. There is often tenderness and abdominal distention, both of which were

entirely lacking in our case, but rigidity and muscle spasm are not seen except in the very late stages, when there is peritonitis from perforation or passage of organisms through a gangrenous bowel. As the condition progresses the coil of intestine becomes more and more distended with fluid and gas and may be felt as a tumor, and there may be dulness in the flanks from free fluid in the peritoneal cavity. A more constant finding is a feeling of resistance to palpation, as in the present instance, which does not amount to the sensation given by an actual tumor. Vomiting is a marked disturbance simulating the picture of intestinal obstruction. It tends to decrease after the first few hours, thus suggesting that it is reflex rather than due to a complete obstruction. The vomitus may contain blood, but rarely becomes fecal. There is usually complete absence of voluntary bowel movements from the onset, and it is difficult to obtain a satisfactory movement, although complete obstruction is most unusual. In rare cases there is diarrhea with bloody stools. In the present instance there was frequent and severe vomiting without any blood during the early hours. This ceased entirely following an enema given seven hours after onset. There was no diarrhea and an enema resulted in a normal movement without blood. There is no rise of temperature except in the late stages. The pulse is striking, and sooner or later leads one, as in the present instance, to suspect some grave intra-abdominal vascular disturbance. The pulse becomes rapid and small as the condition is well established. With the pallor and often cyanosis of the skin, normal or subnormal temperature, there is presented a well-marked picture of shock. It is said that there is a rapid drop in hemoglobin, due to the loss of blood into the infarcted area. Little has been said of leukocytosis, which in our case was 21,000, although this count is not unusual with any type of intestinal obstruction.

The extreme variations in the symptoms and clinical picture account for the frequent failure in diagnosis. In the

present instance the possibility of ovarian cyst with twisted pedicle was considered, and, I must confess, that mesenteric thrombosis did not occur to me. Intussusception, volvulus or some other form of mechanical obstruction is difficult to differentiate, as is also acute pancreatitis; and the conclusion reached by the surgeon is that there is some lesion associated with the intra-abdominal vascular system which demands operative interference. Loop[1] emphasizes the point that it is mechanical as contrasted with an infective process—a fact which should be an aid to diagnosis in the early stages. Occasionally the diagnosis is made before operation.

In the 4 cases which I have personally encountered, the first was operated upon for abdominal symptoms in the course of typhoid fever, an intestinal perforation being suspected. The symptoms proved to be due to a very extensive ascending thrombosis which involved the mesenteric vessels. Practically the whole intestine was involved and death rapidly resulted. The second case, a male, aged forty-one years, was seen at the Johns Hopkins Hospital in July, 1900, having been suffering severely for four days with agonizing pain just to the left of the umbilicus. He had had frequent vomiting and no passage of the bowels for two days before admission. His temperature was 102°, pulse 140 and respiration 31; skin cold and clammy; lips and mucous membranes pale; abdomen distended uniformly and tender on pressure, especially on the right side. There was dulness over the right lower abdomen extending nearly to the median line; no visible paristalsis. The general aspect of the man strongly suggested a severe intra-abdominal hemorrhage. A diagnosis of mesenteric thrombosis was made and immediate operation advised. The peritoneal cavity contained a large quantity of bloody fluid, and a large distended blue-black coil of small intestine was found filling the right side of the abdomen. The mesenteric arteries were thrombosed. Intestine amounting

to 275 cm. was excised, the ends being brought out on the abdominal wall. An anastomosis was not done because of the extremely grave condition of the patient. He died seven hours after the operation. No autopsy was permitted and the exact location of the coil of small intestine was not determined. As I remember it, the diagnosis was made because of the history of obstructive symptoms, the general shocked appearance of the patient and the dulness in the right side of the abdomen, his whole condition giving the impression of a grave intra-abdominal vascular lesion. The third case, seen in the last year, was a man, aged fifty years who was brought into the Emergency Hospital in a moribund condition with a history of three days' illness, characterized by sudden onset of intense abdominal pain with continuous vomiting and subnormal temperature. He was in extreme shock, cyanosed, cold and clammy. He presented much the same picture as the second one and mesenteric thrombosis was suggested as a possible diagnosis. He failed to react to heat and stimulation, and died in an hour or two, no operation being attempted. Autopsy showed mesenteric arterial thrombosis with involvement of several feet of lower small intestine. Thus in our 4 cases the diagnosis of mesenteric thrombosis was properly guessed in 1 and suspected in a second. Finney[2] reports an interesting case in a patient who had suffered for years with Raynaud's disease and had been in the hospital many times for treatment. She suddenly developed abdominal symptoms in the course of a severe attack and came into the hospital with a diagnosis of acute intestinal obstruction. Finney "made a diagnosis rather jokingly of mesenteric thrombosis, operated and found three feet of ileum just above the ileocecal valve involved. He did a resection and she made a good recovery."

In regard to treatment, it is naturally surgical. Operation at the earliest possible moment with immediate resection of the affected area with a safe margin of healthy bowel

offers the best chance of recovery. The results, however, are disappointing from a statistical point of view, the mortality in operated cases being variously estimated from 75 to 90 per cent. Klein,[3] in an excellent article last year, stated that about 24 successful resections had been reported since Elliott's first case in 1895. Undoubtedly they are not so uncommon, for in the discussion of Mason's[4] paper before this society last year 3 successful cases were added to his and McGuire has recently reported 2 more brilliant results.

In a paper by Ross,[5] it is stated that in the records of the Lankenau Hospital, in Philadelphia, during a period of ten years, in 30,000 surgical cases there were only 2 of mesenteric thrombosis. He reports 5 cases, of which 1 recovered after operation. In this patient, operated upon by Deaver, there was found a thrombosis involving a segment of ileum, the amount not noted. The bowel was in fair condition and the abdomen was closed without resection. In the discussion of this paper, Peck reported 2 cases of probable mesenteric thrombosis. In the first case the amount of intestine involved was so extensive that resection was not considered. He did a cecostomy for the purpose of irrigating and the patient recovered. In the second case, where the question of thrombosis was uncertain, but the intestine dark and swollen, without discoverable cause, it was simply returned and the abdomen closed with subsequent recovery. These cases would seem to show that in some instances the involved bowel may be taken care of by collateral circulation, or that there may possibly be an incomplete obstruction of the vessels, so that the bowel is capable of restoration of circulation and function. It is probable that many postoperative abdominal disturbances may in reality be due to temporary or incomplete occlusion or to the blocking of a small branch of the mesenteric, the function of which is quickly assumed by collateral circulation. Klein reports in detail 9 cases in which there was a prob-

able diagnosis of mesenteric occlusion, all of which recovered spontaneously. This, nevertheless, does not affect the rule that with acute symptoms and a suspected diagnosis of occlusion of the mesenteric vessels the only rational procedure is abdominal exploration.

A feature of the sequelæ in the case herewith reported has been the frequent bowel movements, which might be explained by the free anastomosis between the small intestine and the cecum with the elimination of the ileocecal valve. The removal of eighteen inches of small intestine would not seem to be sufficient to have an etiological influence, and there has been no disturbance of nutrition.

As it is sometimes necessary to remove a large section of intestine in order to make an anastomosis in healthy tissue, it is interesting to consider just how much can be taken away with a chance of recovery and what may be expected later in the way of interference with metabolism and nutrition. This subject has been carefully studied by Flint,[6] who collected from the literature 58 cases in which more than 200 cm. of small intestine has been removed. Of these, 49 survived the operation. The greatest amount resected was 540 cm. in a case of strangulated hernia reported by Brenner. This patient apparently recovered with little disturbance of nutrition, but died two and a half years later of inanition.

The clinical manifestation of the metabolic disturbance consists largely of a diarrhea, usually slight, with two or three soft or fluid movements a day. The stools show inability to absorb fat. In other cases the diarrhea is of a fulminating character and may contribute actively to a fatal outcome. Another type of reaction is shown when the patients recover temporarily, but suffer from such profound limitation of the power of absorption that they die later, as in Brenner's case. Experiments on animals show that there is a compensatory hypertrophy as well as hyperplasia of the remaining portion of the small intestine. Flint con-

cludes that in humans, as in animals, about 50 per cent of the small intestine may be removed without much danger of serious consequences in the majority of cases. The resection of smaller amounts may, however, be followed by severe metabolic disturbances, and even inanition and death. The metabolic disturbances bear no definite relationship to the amount of small intestine resected. Resections of over 400 cm. have recovered, while death from inanition has resulted from the removal of 284 cm. and profound digestive disturbances from the resection of 192 cm. of ileum. The surgical rule then is to resect always as little of the intestine as the pathological condition will allow. The metabolism of patients who have undergone extensive resection should be aided by a rich and easily assimilated diet, poor in fats and relatively rich in carbohydrates.

References

1. Loop: Jour. Am. Med. Assn., 1921, lxxvii, 369.
2. Finney: Tr. Am. Surg. Assn., 1920, p. 401.
3. Klein: Surg. Gynec. and Obst., 1921, xxxiii, p. 385.
4. Mason: Tr. South. Surg. Assn., 1921, p. 348.
5. Ross: Am. Surg., 1920, lxxii, p. 121.
6. Flint: Johns Hopkins Hosp. Bull., 1912, xxiii, p. 127.

DISCUSSION

Dr. Lloyd Noland, Birmingham, Ala.—I have been much interested in the subject of mesenteric thrombosis for a good many years. In 1912, I reported, in collaboration with Dr. Fred C. Watson, who is now practising surgery in Memphis, an unsuccessful case, operated on four days after primary onset. Since that time I have had another unsuccessful case.

I am taking this opportunity to report what I consider a very interesting case which came under my observation in March, 1922. A young woman, aged about twenty-four years, had been in the hospital under observation for a bilateral salpingitis for sixteen days, and was discharged as improved on February 14.

On March 26 she was again admitted to the hospital with diagnosis of intestinal obstruction, with symptoms beginning about two hours before admission to the hospital. At the time of admission the patient was in a state of extreme shock, with marked pallor, nausea and vomiting and small and rapid pulse, in other words, the classical picture of acute intra-abdominal hemorrhage. She was observed for about two hours. About four hours after the onset of the acute attack the abdomen was opened through a right rectus incision, revealing about thirty-four inches of ileum absolutely black, with marked edema of the mesentery. There was a considerable amount of free fluid in the abdomen. The line of demarcation was very definite. The gangrene extended to within about four and a half inches of the ileocecal valve. An end-to-end anastomosis was done by the Parker-Kerr technic and the patient made an uneventful recovery.

I report this case as being interesting in several ways: First, because of the very short time elapsing between the onset of symptoms and operation; secondly, because a tentative diagnosis of mesenteric thrombosis was made before operation; thirdly, because the patient recovered. I forgot to mention that there was considerable blood in the colon which was expelled about two hours after operation, and also that the leukocyte count at time of admission was 6000 and that it increased to 17,000 in two hours before operation.

Dr. James M. Mason, Birmingham, Ala.—My interest in this subject has been sustained for several years. Dr. Noland reported some cases in 1912. A short time after reading his paper I encountered a postoperative case which was fatal, and last year I reported a case before this Association in which sixty-five inches of the small intestine were resected, with recovery of the patient. I was glad to hear of the successful outcome of Dr. Noland's case as well as the one reported by Dr. Mitchell. Since Murphy's first operation only about 24 successful cases have been recorded. I feel, however, from the discussion which took place in this Association last year, and from the discussion tonight, that not nearly all the successful cases have been reported. The mortality rate is so high that I think all successful cases should be placed on record.

One word in regard to the diagnosis of fulminating abdominal diseases: There are certain features which are common to

several different intra-abdominal diseases making a differential diagnosis difficult, if not impossible, until the abdomen is opened. All cases with high leukocytosis, increasing pulse-rate and severe abdominal pain demand prompt operation. All cases presenting these symptoms, unless we can definitely diagnose an acute appendicitis or an acute gall-bladder infection, ought to be operated on through a mid-line or a right rectus incision. This incision will allow for exploration and extensive operation if any condition is found which requires it.

Dr. Willard Bartlett, St. Louis, Mo.—I wish to take up a moment of your time for two reasons: The first is on account of the rarity of this condition. As the preceding speaker has said, we should put all these cases on record. I have had two, and I will state the other reason in connection with one case. One man was seen the third day in an abdominal attack in whom typical conditions such as those outlined presented themselves. After the abdomen was opened the resection of about three feet of bowel was made with fatal issue.

Within about a week of that time, as these strange coincidences run, I was called to a suburban hospital and found a man writhing in agony. The abdominal pain, to which reference has been made, is more severe than any other type of abdominal pain, which should attract one's attention to the likelihood of thrombosis of the mesenteric vessels. The patient was desperately sick with an acute abdominal condition which had lasted a number of hours, as Dr. Noland stated in his case. It was about ten years ago that I saw this case, but for a few hours the patient happened to be having this intense typical pain. At the operation we found lots of free blood in the peritoneal cavity with an astonishingly long semi-gangrenous mass of bowel. I should say at least a third of the small intestine was involved in gangrene. The intestine was hastily resected; the two halves of the Murphy button dropped into either end and the ends closed. A stab was made in the button side of the bowel and clamped together, and the abdomen quickly closed with through-and-through sutures. When we measured we found we had actually resected sixty inches of gangrenous small intestine. The best feature of the case is that the man was alive ten years later.

I should be greatly illuminated if those who are more familiar with the literature than I am will tell me whether or not that

length of intestine has been exceeded. I started to say that I attribute the result to my good luck, or perhaps I had better say to the patient's good luck.

Dr. Francis Reder, St. Louis, Mo.—Every surgeon whose patient survives after an operation for a condition as Dr. Mitchell has described, should be congratulated. The clinical picture that a thrombotic condition of the superior mesenteric artery presents is so grave and gloomy that immediate operation is called for. The clinical picture of an acute abdomen should be convincing that an operative measure is imperative, and that any further attention to diagnostic finesse would mean a serious loss of valuable time.

I wish to cite 1 case out of 5 where recovery took place. The patient was a woman, aged twenty-five years, who was suddenly seized with a very severe abdominal pain while dancing. She was removed to the City Hospital. Four hours later, when I saw her, she was recovering from shock. Her abdomen was greatly distended; muscular rigidity was pronounced; there was no pain; pulse was 64. Temperature was slightly subnormal. Upon opening the abdomen I found, much to my surprise, that everything looked black. A quick orientation revealed a gangrenous ileum. A hasty resection was made. I might emphasize that a consideration of an anastomosis is absolutely out of place when dealing with an acute abdominal condition involving the intestine. After ablation of the gangrenous bowel the distal and proximal ends were brought out of the abdominal wound and secured by suture. The patient was returned to bed in poor condition. A gradual improvement manifested itself as time went on. In three weeks a Dupuytren clamp was applied through the openings of the bowel, clamping the distal and proximal ends. In two months healing had taken place and the continuity of the intestinal tract was restored. The length of intestine removed measured seven feet and two inches.

Dr. E. P. Richardson, Boston, Mass.—Of 4 cases of mesenteric thrombosis and embolism which I looked up, 1 showed a leukocytosis of 97,000 and another of 35,000. I merely wish to mention the occasional value of a very high leukocyte count in the diagnosis of these obscure cases.

Dr. W. Burton Thorning, Houston, Texas.—I made an interesting observation last spring which I want to mention for whatever it may be worth. I happened to be visiting in the country and was called by a physician in that village to see a sick patient. I will not enter into a detailed history of the case, except to say that the patient had been ill four days. The physician had arrived at a diagnosis of intestinal obstruction without giving his reasons why. I made a diagnosis of ruptured tubal pregnancy and I thought it was an opportunity to see if Cullen's sign was present, namely, a peculiar bluing about the umbilicus. It was plainly marked. I called the attention of the attending physician to it and we both saw it clearly. The parents of this young woman would not permit an operation. She was hardly fit to answer for herself, as she was in a desperate condition and full of morphine. Her husband was away. He was a sea captain. She died the following day. The next day her husband returned from his voyage, came to see me and I told him what my diagnosis was. The body was still at the undertaker's, and he requested that an autopsy be made, which was done. Upon opening the belly we found fifty-two inches of ileum perfectly black and a pint or possibly a little more of bloody serum.

The interesting point to me was that this bluing of the umbilicus was very pronounced. There was no free blood in the abdominal cavity, but we removed quite an amount of bloody serum. I am curious to know whether this bluing we saw was due to the serum in the abdominal cavity or to the intense discoloration of the gut.

Dr. Rudolph Matas, New Orleans, La.—I wish to speak of gangrene of the bowel in connection with strangulated hernia and mesenteric thrombosis. I had an experience fifteen years ago at the New Orleans Sanitarium which left a deep impression on my mind. I was called one night to see a middle-aged white woman who had a strangulated femoral hernia of several hours' duration. I had her brought immediately to the hospital, operated, and found a small gangrenous loop of gut which I thought was of the ileum. It was black. I released the constriction and in order to get at the bowel and look at it more freely, I divided Poupart's ligament. I found then that the gangrene of the bowel extended much farther up than the hernial sac. I pulled on the bowel gently to exteriorize it, and

to my surprise I found that as fast as I pulled on the bowel it became detached from the mesentery. The bowel was bluish-black; the mesentery was thin, like tissue paper, and rather pale. The bowel itself was blackish-blue like that of the strangulated loop. I pulled the gut some more, intending to leave it outside, and gently kept on pulling one loop after another. To my surprise and consternation, it kept on detaching from the mesentery until I had at least five and one-half feet of bowel outside of the abdomen, the mesentery tearing away like wet tissue paper. When I reached this stage I stopped, as the remaining bowel seemed to have preserved its normal color; but the thinness and friability of the mesentery were so remarkable that I feared that if I kept on pulling I would have pulled off the entire small bowel tract. I resected the obviously gangrenous portion, brought the two ends of the bowel out of the wound, put them together like a double-barrel shotgun and left them hanging out as an artificial anus. I was not certain how healthy the bowel was beyond the exteriorized part, but the condition of the patient and the fear that even the slightest and gentlest traction might detach more bowel brought my exploration to a halt. The mesentery was not thick, densely ecchymotic and edematous in the manner so characteristic of thrombosis in the mesentery. It was thin and friable and could be pulled away with the slightest traction. On the proximal side of the obstruction, the bowel (ileum) was a little more distended, but it was not the great distention that one would expect in a paralyzed dead bowel. It was a most surprising and unique experience. It seemed to me also that necrosis was progressing while the operation was going on. For a time the patient did well, but on the third day suddenly sank into a state of collapse. She developed an overwhelming toxemia, her pulse fluttered away and she died.

We reopened the wound and found that beyond the point where the gut had been extruded there were patches of gangrenous bowel caused by arterial thrombosis. The necrosis in segments practically involved the whole ileum and part of the jejunum. That experience of pulling the bowel away from its mesentery by the gentlest traction as if it were wet tissue paper is one that I will never forget.

I have read of one or two instances where the mesentery had become detached on slight pulling, but never of such great length of bowel as in this case. This case was evidently one

of mesenteric arterial thrombosis or embolism associated with some congenital hypoplasia of the mesentery, because the mesentery was not infiltrated, was not at all edematous and not hemorrhagic or cyanotic. As far as we could ascertain, there was no positive evidence of septic endocarditis or arterial disease that would account for the arterial obstruction.

Dr. Mitchell (closing).—I cannot answer the question as to the greatest length of bowel which has been successfully removed for this particular condition. In Flint's paper the greatest amount he was able to collect was 550 cm., I think. That was a case of strangulated hernia in which the conditions are different.

I regret that the physiological side of this subject was not discussed to some extent, because that to me has been the interesting part of the case, namely, why a girl, with only eighteen inches of intestine resected, should have a tremendous upset in her intestinal condition by having every day two or three or four soft movements. It is a source of great annoyance, and I have tried to explain it by the large opening between the ileum and cecum which the roentgen-ray man told me is not so. Just how to explain that I do not know. As far as Flint could ascertain by experiments and the literature, the point has never been cleared up. As I stated in my paper, it seems to bear no relation to the amount of intestine resected. It occurs when the lower ileum is resected, but the amount does not seem to be so important.

STRANGULATED DIAPHRAGMATIC HERNIA OF TRAUMATIC ORIGIN, WITH REPORT OF A CASE

By Jere Lawrence Crook, M.D.
Jackson, Tenn.

The case which furnished the inspiration for this paper consulted us on December 19, 1920, one year before the last meeting of this Association, at which time the operative treatment of the condition was ably presented by a fellow-member, Dr. H. B. Stone. The subject of "Hernia of the Diaphragm," as suggested by him, has received much attention during the last five years, due to the influence of war wounds in the production of this condition and the use of the roentgen-ray in its diagnosis.

In view of the large proportion of cases of traumatic origin, it would not be far-fetched to consider every left-sided gunshot and stab wound of the chest as a potential diaphragmatic hernia. It is easy to understand the mechanics of traumatic hernia of the diaphragm if one considers the features involved in its formation. Of primary importance is the force of aspiration of the thorax which is exerted through the small slit in the diaphragm on the freely movable abdominal viscera. This constant suction, due to the negative pressure in the thorax, is aided by other factors within the chest. First of all, the omentum enters the opening and prevents union of the edges. This is followed by the formation of adhesions with the thoracic organs, and upon contraction of these adhesions the abdominal

organs are dragged upward. In addition, the pleura has a decided tendency to the formation of exudates and the intraperitoneal pressure is increased.

"The stomach and colon are the organs most commonly herniated, the spleen and small intestine being involved less frequently. In many cases the herniated organs are twisted as much as 180 degrees. The severe nutritional disturbances of the colon are easily explained by this incarceration and torsion." (Orth.) These conditions do not prevail on the right side of the chest, due to the presence of the compact and plastic liver, just beneath the diaphragm, which adheres and plugs the rent. Therefore, right-sided diaphragmatic hernia is exceedingly rare.

The case which I shall report presents such unusual features that I shall describe it in detail and follow with a brief review of the recent literature, confining my discussion to "Diaphragmatic Hernia of Traumatic Origin."

J. W. Van C., aged thirty-five years, residing at Luray, Tenn., was admitted to the Crook Sanatorium on December 19, 1920, with a history of having suffered six days and nights with intestinal obstruction, accompanied by persistent vomiting and extreme pain in the left splenic region and also great tenderness over the appendix. The case was described to me over the telephone as "locked bowels" following a case of appendicitis. The patient arrived shortly thereafter in a desperate condition. A careful examination of the abdomen showed great distention and tenderness present over the whole area, but most marked over the appendiceal region. He stated that his greatest pain had been on the left side underneath the ribs at first, but for the past two days it had been centered over the appendix, and this was the point of greatest tenderness on palpation. He had been treated two years before for an attack of pain and vomiting which was diagnosed as appendicitis. The history of the case and the patient's condition presented features that

could not be explained on the theory of appendicitis alone. On account of the history of extreme pain in the left costal region, it was decided to give an enema of barium solution in the effort to locate the point of obstruction in the lower bowel. The patient was placed on the roentgen-ray table under the fluoroscope, and with Dr. O. O. Jones, roentgenologist, and Dr. C. F. Webb, my surgical associate, we watched the progress of the barium solution through the rectum and the sigmoid up to the splenic flexure of the colon, where it stopped abruptly. We did not wait for further study of the case, but prepared the patient for immediate operation. On account of the tenderness in the right side with a history of appendicitis, together with an evident complete obstruction on the left side, I decided to make a median incision so that I could reach both sides. As soon as the abdomen was opened an enormously distended ascending colon with a distended and highly inflamed appendix appeared. The colon filled the entire field. Before proceeding further the appendix was removed. Then I made a careful examination, with my hand following up the distended colon, and found a slit in the diaphragm through which the entire transverse colon, together with the splenic flexure and a large portion of the greater omentum, had been sucked up into the chest cavity. We were somewhat prepared to find this condition, as after the patient was placed on the operating table, and just before the incision was made, one of the nurses in raising his shirt exposed an old scar in the left side between the seventh and eighth ribs, which was first observed by Dr. Webb and the possible causal relation of this old wound to the obstruction suggested by him. The patient at that time was anesthetized and we could not get the history of the scar. With my hand in the abdomen I was able to insert two fingers in the diaphragmatic opening and attempted to withdraw the incarcerated colon, but found this exceedingly difficult. When I would withdraw a small portion of it the suction of the chest would draw it

back. The enormous distention of the ascending colon completely blocked the field, so that it was impossible to see anything and my work had to be done by the sense of touch. I soon found that reduction of the hernia could not be made unless the opening was enlarged. It was impossible to use a knife from below on account of the distended colon occupying the entire field. I did not like to lose the time necessary to get ready for a thoracotomy, as the patient's condition was quite desperate. I therefore decided to divulse the rent in the diaphragm until I could get enough of my hand in to make traction on the incarcerated viscera. This I did very gently and was able to grasp first the transverse colon, which I brought down a little at a time, gradually overcoming the suction and adhesions until I had replaced all of the colon in the abdominal cavity. I then followed the same procedure with the omentum. After replacing the bowel and omentum within the abdominal cavity, I found the distention of the entire colon so great that it was impossible to close the incision. I therefore placed a purse-string suture in the distended colon, introduced a gall-bladder trocar and cannula through the middle of the area circumscribed by the suture and evacuated sufficient gas and liquid feces to collapse the bowel. The cannula was carefully withdrawn, the purse-string suture drawn taut as it emerged, the bowel replaced and the incision closed in the ordinary manner. The patient made an uneventful recovery and left the hospital on the seventeenth day.

During his convalescence he refused to condider a second operation to close the rent in the diaphragm. I insisted on his returning at a later time and allowing me to do this in order that he might escape further trouble, but he would not do so. In response to repeated efforts to get him to come in order that I might examine him as to the advisability of operating to repair the diaphragmatic rent, he finally came last Saturday, December 9, and we were able

to make the roentgenograms which I herewith present. He also consented to present himself at this meeting, and he is here. He says he has had no pain nor disability within the two years since the operation.

A few days after the operation I secured the following history, which would have thrown light on the case the night of his arrival, but, as stated, the patient's condition was so desperate that we did not take time for a careful history. He stated that twelve years previously he had been stabbed in the left side with a knife; two years before coming to me he had pain in his left side, followed by vomiting which lasted a day or two, and was followed by some obstruction of the bowels. He had had occasional cramps since that time. He had been told that he had chronic appendicitis, and so stated the night of the operation. He also stated regarding his present ailment that he was assisting in loading a 300-pound pole of wood, and when he lifted it up and laid it down he felt a keen pain in his left side, but worked on nearly two days with his side still hurting him, the pain gradually extending over his entire abdomen. He commenced vomiting two days after the pain began and had had no passage from the bowels since the pain started, and had vomited until he was brought to the sanatorium.

As stated at the outset, this case occurred in December, 1920, one year before the last meeting of this society, and every quotation from the literature used in this paper comes from papers printed in 1920, 1921, 1922, which, of course, were not available when I operated on this patient. The case has led me far afield into a most interesting study of the recent literature, and the surgical technic of operators in America, Germany, France and England has been compared.

P. E. Truesdale[1] outlines the literary history of this subject from 1610, when the first 2 cases were reported by

[1] Jour. Am. Med. Assn., 1921, lxxvii, 993–998.

Paré, to 1853, when a monograph by Bowditch appeared. This latter compiled 88 cases, exhausting the literature up to this time.

Up to that time (September, 1921) about 43 cases from battle wounds had been added to the literature by the recent war.

The same author,[2] in discussing the frequency of operation for diaphragmatic hernia, reports that Scudder found 53 cases recorded up to 1911, and Frank, in 1919, could add only 41 additional cases. From 1918 to 1920 inclusive, 96 cases have been reported. Of the 96 cases collected 43 were the results of battle casualties, and he adds that the rapid increase in the number of operations for this condition is manifest, while there is no doubt that the number of cases treated and not reported is considerable. He states that intestinal obstruction is the outstanding factor of risk to life. In Scudder's series the surgical mortality was 75 per cent, essentially because of intervention during strangulation of the transposed viscera. Unlike this accident in other types of hernia, the process is concealed and the symptoms and physical signs somewhat strange. Hence, delay is the rule and the mortality exceedingly high. The operative mortality depends upon the number of cases encountered during acute intestinal obstruction. Warren reported 8 cases treated surgically during ten years at the London hospital. Only 1 lived. 7 were oprated upon in the presence of acute obstruction. The general mortality after operation in the non-strangulated type averages 10 per cent.

Truesdale favors the thoracic approach to the diaphragm for the surgical treatment of diaphragmatic hernias. He says that the majority of American and British surgeons have preferred the abdominal approach, but that the French prefer the thoracic operation. But, of course, no one plan of approach is best suited to all cases. French surgeons also have used a third method, which combined the thoracic

[2] Ann. Surg., Philadelphia, 1921, lxxiv, 347.

and abdominal approach, and has been termed a "thoraco-laparo-chondrophrenotomy."

In connection with other statistics on diaphragmatic hernia R. P. Rolands[3] reports that Marshall Lloyd found only 2 cases recorded in the surgical reports of Guy's Hospital between 1866 and 1920. Both were due to crushing, and the patients died shortly after admission to the hospital without an operation. Out of 413 cases analyzed by Grosser and Thoma, 232 were congenital and 181 acquired; "but it is often very difficult to settle this point."

In comparing the abdominal and thoracic operations, the author states: "In 52 traumatic cases without strangulation, analyzed by Binnie, the mortality for the thoracic route was only 9.6 per cent, compared with 50 per cent for the abdominal route; in cases with strangulation the mortality was 50 per cent for the thoracic route and 100 per cent for the abdominal (Neugebauer). Scudder analyzed 55 operations—11 thoracic with 7 recoveries, and 42 abdominal with 7 recoveries. It is possible, however, that the abdominal route was adopted in the most severe cases on account of signs of associated injuries in the abdomen."

D. L. Borden writes in a recent article (1922) that up to the beginning of the Great War, 650 cases of diaphragmatic hernia had been reported in the literature, and that only 15 of this number had been diagnosed before operation or autopsy, but that the roentgen-ray has demonstrated with great efficiency this pathological condition without waiting for operation. Since the onset of the war increasing number of cases have been reported. Borden adds that a recent communication from the Mayo Clinic states that no cases of diaphragmatic hernia have been observed in their hospitals since those reported in 1916 by the late Dr. Beckman, and he reported only 3 cases; 1 seen in 1909, 1 in 1911 and 1 in 1916.

Borden says regarding treatment: "Unquestionably the

[3] Guy's Hospital Report, London, 1921, lxxi, 91–101.

abdominal route is the one of choice." But he adds: "When adhesions prevent the reduction of the hernia from below, a thoracotomy, though adding to the operative risk, may be necessary to enable the operator to free the hernia from above and restore its contents to the abdominal cavity. When a traumatic opening exists in the chest, as in some wounds or other cases, the hernia may be repaired through it from above."

E. C. Roos, in a recent (1921) paper, says that there are two methods of surgical treatment of these hernias, the transpleural and the transperitoneal, and that the former is perhaps the better method, as it permits a better exposure and a freer manipulation of the hernial contents, and also allows a better closure of the hernial openings. Further, with the present method of producing anesthesia in thoracic surgery, this method is gaining in favor.

He also says that if the transperitoneal route is used, the various steps necessary in treatment have to be carried out at a great depth and more or less blindly, although a better approach may be obtained by a resection of the costal arch.

After a careful search of the literature following Truesdale's paper,[4] I have been able to collect 13 additional cases of frankly traumatic origin, including the 1 reported by Dr. Stone last year, which occured in March, 1918.

On the two sides of the important question of surgical technic a study of the literature showed the following advocating the thoracic approach: C. B. Keenan, G. Cotte, M. B. Gordon, D. L. Golann, Sauerbruch-Schumacher in early cases, R. P. Rolands, Llobet, Cranwell, Carson and Barton. Rolands states that very few recoveries have followed operation, especially when the abdominal route has been adopted.

The following advocate the abdominal approach: S. Barling, A. D. Bevan, Dehelly, W. H. Holmes, L. F. Huffman, A. E. Keown, F. S. Matthews, H. M. Imboden, Nieden,

[4] Jour. Am. Med. Assn., September 24, 1921.

Reichel, T. F. Riggs, Balfour, H. E. Waxman, and O. Orth, who advises abdominal approach when ileus predominates. Garre prefers the abdominal approach in simple cases, and in advanced cases with suspected gangrene the thoracic approach; L. Prat, Sauerbruch and Truesdale report thoracic approach in 1 case and abdominal approach in 1 case.

From the foregoing it will be seen that there is a wide divergence of opinion as to the relative merits of approach. I believe the condition of the patient at the time he is first seen should determine largely our decision in this important matter. Where symptoms of strangulation and ileus are apparent the abdominal approach is an absolute necessity. Where the case is a chronic one and the diagnosis has been clearly established and confirmed by roentgen-ray before operation, I believe the combined approach is indicated. From the experience gained in the case herein reported, I feel that every preparation for the double operation should be made in advance provided the diagnosis has been made in advance. The abdominal incision should be made first, and if reduction can be successfully performed and access can be had to the rent in the diaphragm, it might not be necessary to open the chest.

In the case reported, had I been able to diagnose the condition in advance, the chest could have been prepared, the proper instruments assembled, and when it was evident that the suture of the torn diaphragm could not be done from below, a rapid thoracotomy would have made it possible to repair the rent. In this event an assistant with his hand in the abdomen can be of vast benefit to the operator by controlling the viscera and elevating the diaphragm from below while the operator works from above through the thoracic incision. However, I do not believe my patient would have survived had I undertaken a thoracotomy to suture the diaphragm after relieving the obstruction. He was dying from intestinal obstruction, and I operated to save his life by relieving the obstruction. He recovered

because the operator preferred an incomplete operation and a live patient to a technically perfect surgical feat and a fatal result.

I wish to add to my own paper the following recently reported cases which are typical examples of traumatic hernia of the diaphragm:

C. B. Keenan[5] reports 2 interesting cases, both of which were successfully operated on by the thoracic approach.

Nieden[6] reports a case of strangulated hernia, with complete retention of feces, for one week, the patient having been run over one year before the present illness began. He did a laparotomy with median incision, and after replacing the herniated transverse and descending colon, spleen and greater omentum, he sutured the rent in the diaphragm from below. After the operation was completed severe symptoms of pneumothorax set in, but disappeared when thoracotomy was performed.

A case which is strikingly similar to mine was reported by H. E. Waxman.[7] It occurred several years after a bullet wound of the chest, and was strangulated, causing intestinal obstruction. It involved the splenic flexure of the colon and was complicated with acute appendicitis. The appendix was removed and the hernia reduced through the same incision. In his case the result was fatal.

Our Fellow, Dr. H. B. Stone, at the meeting of this Association last year, in his judicial discussion of the question of approach, seems to me to have fairly presented the subject from both angles. I believe his conclusions are sound and deserve restatement and emphasis:

"1. Abdominal exploration is essential in the great majority of cases of diaphragmatic hernia.

"2. Thoracic approach greatly facilitates the necessary operative steps.

[5] Ann. Surg., Philadelphia, 1922, lxxv, 625.

[6] München. med. Wchnschr., 1920, lxvii, 1188.

[7] Jour. Am. Med. Assn., Chicago, 1922, lxxix, 123–124.

"3. The method of choice, therefore, for the routine handling of these cases should be by combined abdominal and thoracic incisions.

"4. These incisions are best made separately, instead of by the French method of a continuous incision."

I wish to add a fifth conclusion:

5. The roentgen-ray is a positive means of diagnosis in this condition, and its use should never be omitted.

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DISCUSSION

Dr. W. W. Grant, Denver, Col. (by invitation).—I happened to be in Jackson and my attention was called to this case reported by Dr. Crook. I examined the man with a good deal of care, and the one question asked in the case about which I have a positive opinion is as to the need of a future operation. I have been a surgeon for a quarter of a century, and I have learned one valuable lesson, and that is, to let well enough alone. It would be unwise, in my opinion, for this man to permit the

most skilful surgeon to operate on him again when he is so well and able to discharge every duty, and with some doubt as to the result of another operation.

I have been interested in the case history and the operative comparison made by Dr. Crook. I have long been convinced that a really great surgeon is one who knows when to operate, when not to operate, as well as how to operate, and it requires these three qualities to make a real good surgeon.

I have seen some very distinguished surgeons perform operations with the finest technic but who have displayed little or no surgical judgment. I have seen admirable work in clean cases; on the other hand, I have seen the same operator fail in complicated cases, such as a appendicitis with perforation, abscess, gangrene and even intestinal obstruction, because he had not employed the discriminating quality of the surgeon which would enable him to determine what best to do in a given case. My own judgment ever has been that the surgeon himself should in all cases be governed by the clinical history and present condition of the patient, rather than by any set rules which any group of physicians or surgeons might formulate. After all, he is the safest surgeon who is governed by observation and experience, and the condition of the patient as presented.

In this case, it seems to me, Dr. Crook did the wisest thing in reducing the hernia and temporarily bridging the man over until he could get in a better condition for a more elaborate operation; but this necessity may never arise. If I were the patient I would be satisfied to go along and do my work and not undergo another operation when so well under present conditions. I would commend his wisdom in waiting for manifest disability or a danger signal before another resort to the knife. Differentiation by the operator is as important as in the diagnostician.

Dr. David Woolfolk Barrow, Lexington, Ky. (by invitation).—I wish to speak of my case of diaphragmatic hernia. It illustrates the difficulty that is sometimes encountered in making a diagnosis and effecting a cure in this condition.

My patient was a man, aged thirty years, who was referred to me from Hazard, Kentucky. This man had been shot five days before I saw him. The bullet had entered just to the right of the spinous process of the tenth thoracic vertebra and had

lodged in the ninth intercostal space in the mid-axillary line just inside the skin. The bullet had been removed by his local physician. The patient was apparently *in extremis;* his pulse was 156 and his abdomen was greatly distended, but there was no muscular rigidity.

The symptoms and signs led me to believe that an immediate abdominal operation was advisable. The suspected diagnosis was intestinal paresis, due to injury to the nerves, as judging from the path of the bullet it did not seem possible that the latter had entered the abdominal cavity.

Enterostomy seemed indicated, so a left rectus incision was made and the first loop of the ileum encountered was brought into the incision and sutured there. This loop of ileum was greatly dilated. There was no evidence of peritonitis. No exploration of the abdomen was attempted. Six hours later an opening was made into the ileum.

The patient gradually improved. A clamp was applied to the intestine, as in the Mickulicz operation. This clamp sloughed through in several days. A few days later the abdominal wound was closed in the usual way. Ten days later the patient showed signs of an acute intestinal obstruction. I decided that it would be better to make a new incision to the side of the old one and make a lateral anastomosis rather than reopen the ileostomy. This incision showed that the present obstruction was caused by a loop of ileum being caught between the abdominal wall and that loop of ileum that had been used for the enterostomy. To relieve this obstruction it was necessary to disconnect the enterostomy loop of ileum from the abdominal wall. This was done by a cautery. Convalescence from this operation was satisfactory, and the patient was thought cured.

Three months after dismissal from the hospital the patient returned to our clinic, stating that during the past month he had had great discomfort after eating, and that he vomited practically everything eaten. He was put through a fluoroscopic examination by Dr. Wyatt, who made a diagnosis of diaphragmatic hernia.

Not having previously closed an opening in the diaphragm, I was interested to find out the technic of suture that should be employed in the closure. I was greatly impressed with the paucity of descriptions on the subject. As you all realize,

this closure demands an approximation and immobilization of the freshened edges of a muscular structure that is in constant motion.

It seemed to me that the stitch described by Soresi was most likely to be satisfactory. I hope Dr. Crook will give us his opinion upon this phase of his subject.

The abdominal approach was used. Fortunately there were practically no adhesions to the opening, so a reduction of the hernia was accomplished without difficulty. Approximately one-half of the stomach, two feet of the small intestine and one and one-half feet of the colon and a large part of the omentum had entered the pleural cavity. The opening was closed as previously mentioned. Silk was the material used.

Unfortunately the patient's difficulties were not yet completed, as the wound became infected. This infection extended into the chest and resulted in an encapsulated empyema which finally necessitated a thoracotomy and drainage. The patient finally recovered and the roentgen ray demonstrates that the diaphragmatic opening remained closed.

Dr. Rufus B. Hall, Cincinnati, Ohio.—I want to discuss the discussion a little bit. Dr. Grant said that if he were the patient he would not be operated on again. Probably if he were in the same condition as the patient he would not be operated on to close this opening, but personally I would want to feel I was pretty close to that doctor who operated on me so that, if necessary, I could take the first express train to go to the hospital if I did have a strangulation of the hernia again.

Dr. John D. S. Davis, Birmingham, Ala.—The proper approach to hernias of this kind is through the abdomen. I have had 1 case, however, in which I was not able to reduce the hernia through an incision in the abdomen, and I opened the chest by resecting two ribs, and through this opening I was able to reduce the bowel, and through the chest opening the diaphragm was imperfectly done.

I have had 3 traumatic cases of hernia which were reported to this Association in which the diaphragm was closed through the chest. In 2 cases I did a supplementary laparotomy, fearing injury of the abdominal contents. In one of them I found no injury. In the second case there was an opening in

the stomach. All the patients recovered. I have had altogether 5 cases of traumatic hernia of the diaphragm.

Dr. Joseph A. Crisler, Memphis, Tenn.—I have nothing but praise for the work our associate has done in this particular case. However, I should like to sound a note of warning to some of us for the future, fearing we may have a postperitoneal hernia through the duodenal fossa, as I have had, and mistake it for a diaphragmatic hernia. It would be difficult, unless one was in close touch with what he was doing, to distinguish between the two conditions. One case I had I would like to mention merely to emphasize the fact that this patient has as his principal symptoms paroxysmal pains, rhythmic, like a woman in labor, every minute, covering a period of two days following a baseball game. An incision was made in the midline and the herniation found in the subduodenal fossa. About five feet of intestine was drawn out of the postperitoneal area. Where it came from I do not know. It was sufficiently constricted to cause pain of the paroxysmal type. I agree with Dr. Crook that the higher up the intestine the enterostomy is made the more important it is. My principal object in rising was to sound a note of warning that many of us may think we have a diaphragmatic hernia to deal with when we really have a postperitoneal hernia.

Dr. Frank D. Smythe, Memphis, Tenn.—I agree with Dr. Crook that one of the most important, if not the most important, functions of the physician and the surgeon is to relieve the patient of the symptoms complained of and to protect him against threatened disaster by removing the cause responsible for the existing condition. I think Dr. Crook did that in a masterly way.

Diaphragmatic hernia is a rare condition, at least it has been observed by myself in but one instance, nor do I recall any other case in this community. So far as we could ascertain there were no symptoms suggestive of diaphragmatic hernia prior to the time the patient received the gunshot wound, which proved fatal. The man was a merchant in the suburbs of this city. He was held up by a robber and shot at close range with a very large caliber bullet. The bullet entered on the right side at about the ninth costal cartilage and ranged upward and passed under the first portion of the duodenum

and behind the grinding portion of the stomach, cutting a passage in its course sufficiently large to enable us to follow it without stretching the tissues but little, if any.

The bullet produced an opening in the diaphragm of good size and the patient's abdominal cavity contained a large quantity of fresh blood. He was in collapse at the time he reached the hospital—in fact, was dying of hemorrhage.

Abdominal incision was made at once and investigation revealed that a good portion of the stomach was in the thoracic cavity. There were two large openings in the stomach made by the bullet. The openings were sutured rapidly, with the hope that hemorrhage might be arrested. The man's condition was such that no effort was made to find out how the stomach had gotten into the thoracic cavity.

The patient was transfused. He lived but two days, dying from hemorrhage and peritonitis. The diaphragmatic hernia in this case was probably responsible for the man's death, as a good portion of the bleeding occurred from that portion of the stomach which was occupying the thoracic cavity at the time he was shot.

I wish to concur in what Dr. Grant says in regard to this patient concerning future operations. Certainly, I would not in his condition undergo an operation as a prophylactic measure. However, in the event of recurrence of symptoms similar to those experienced before I would consult that surgeon who displayed such good judgment in handling me formerly.

Dr. Francis Reder, St. Louis, Mo.—It is remarkable what a change comes over the surgeon as years of experience grow upon him. He is not less courageous, but he is more careful. A junior member of the profession, I have no doubt, would most likely have operated on this man by this time. Dr. Crook's paper is what I term a very apt paper. In explaining what I mean, I wish to say that there was a time when I rather prided myself on small incisions in removing an appendix. I have relegated these short incisions to the days gone by, and now make an incision large enough to permit me to make a thorough exploration of the whole abdomen.

An excellent illustration is Dr. Crook's case. He had the clinical picture of an appendicitis lesion. Even though the appendix was diseased, he was not content with that pathology

alone. He enlarged the incision sufficiently to make a more thorough exploration of the abdomen and found the condition which is now presenting such a perplexing aspect.

Dr. Walter C. G. Kirchner, St. Louis, Mo.—The case of Dr. Crook's illustrates several points. Some sixteen years ago I read a paper entitled "Surgery of the Diaphragm," and it was encouraged by a somewhat similar case in which I found accidentally a condition of true diaphragmatic hernia. The types of cases that are usually reported are not true hernias, but prolapses through the opening, and the case I reported in my paper was a true hernia in which a stab wound of the diaphragm had been received; the stab wound not having penetrated the diaphragm completely, left a weakening through which the omentum ascended in a well-formed sac. I made several experiments in regard to the possibility of penetrating the diaphragm.

In the first place, we must consider the diaphragm as a dome-shaped arrangement, and in all emergency work, especially in hospital work, the interns should be properly instructed in regard to the great danger of abdominal injury in thoracic penetrations which are likely to injure the diaphragm. Whenever the diaphragm is injured there is this great danger of prolapse which ultimately results in obstruction just as in this case. The lesson is this: In all these cases operation is required. A thorough exploration should be made and the diaphragm should be carefully examined. The next point is, if perforation is found it should not be left, as has been advocated, but it should be closed, and then such a condition as happened in the case of this man would be avoided. The chief thing to be recognized is that all injuries of the diaphragm should be sutured and closed. Any opening or weakness in the diaphragm differs in no respect from a weakness in the abdominal wall at other locations. A weakness in the inguinal region should be closed and the same thing obtains in an opening in the diaphragm. If this man had an inguinal hernia we would recommend that it be repaired, and so too should a hernial opening of the diaphragm. Notwithstanding the great wisdom of letting well enough alone, the surgical fact still remains that openings of the abdominal cavity should be closed to prevent hernia and strangulation of viscera.

The opening in the diaphragm can always be made accessible by introducing the finger and then drawing down the diaphragm. A suture can be placed and the opening brought into view. You can place the sutures easily and you have it under control at once. Where you have both a wound in the chest and abdomen, you have resort to either the abdominal or thoracic route. Either will prove satisfactory.

Dr. Crook (closing).—I want to thank the patient for sticking by me toward the close. When I found it was necessary to do an enterostomy, I felt if I cut into the appendix there might be an effusion, so I removed the appendix. The colon was greatly distended and black, and all the surgical work was done by the sense of touch.

TWO CASES OF CALCULI IN THE SEMINAL VESICLES

By George Tully Vaughan, M.D.
Washington, D. C.

(Read by Title)

These two cases are reported in order to invite the attention of the profession to the fact that concretions may form in the vesiculæ seminales, that they may cause serious trouble and that they are likely to be mistaken for stone in the ureter. It does not seem to be a common condition, judging from the scarcity of literature on the subject.

Case 1.—J. L. B. aged twenty-eight years; District of Columbia; war risk insurance; operated on at the Providence Hospital by me October 16, 1920.

History. Some time before he had been operated on for appendicitis. Later, pain returned in the lower part of his right side and three weeks before admission to hospital he had a severe attack of pain in this region, it being the third attack of a similar character which he had suffered within a few weeks, and was attended with the passage of bloody urine.

A diagnosis of calculus in the right ureter was made and the roentgen-ray confirmed the diagnosis, showing four small calculi in the region of the ureter at the base of the bladder. Some doubt was felt as to whether the stones were in the ureter, in veins or in the seminal vesicle.

Under general anesthesia the ureter was exposed by an oblique incision along the side and front of the abdomen behind the peritoneum. Palpation of the ureter failed to detect a stone. It was opened and a soft rubber catheter introduced up to the pelvis of the kidney and down to the bladder, with the same result; but with the fingers several small bodies were felt just lateral to the lowest part of the ureter where it enters the bladder, evidently in the seminal vesicle. They were scraped out—four round, pearly looking bodies, in size from squirrel-shot to buckshot. One catgut stitch closed the wound in the ureter and recovery was normal.

Heard from in November, 1922. He was in good health and had had no further trouble.

Case II.—L. A. D., aged forty-two years; male; admitted to Georgetown University Hospital; referred to me by Dr. W. J. Stanton, and was operated on November 8, 1920.

History. Had gonorrhea several years ago and recovered. In 1919 he broke his left radius, and it was wired by a surgeon. He was in the hospital from October 31, 1919, to January 31, 1920, suffering with chills, fever, sweats and pain in the left side, groin, iliac and lumbar regions—with wide variations of temperature range—one day it rose from 97° F. to 107° F., and frequently it varied from 98° or 99° to 104° or 105° in one day. Numerous examinations were made by physicians, surgeons and pathologists, exhausting the resources of the laboratory, including the roentgen-ray, and many guesses were made but nothing definite was discovered to account for his symptoms. The fractured radius, which had united, became loose, but later on again united. His fever finally subsided and his other symptoms disappeared, and he left the hospital after three months apparently well.

He went to work and had no further trouble until about October 20, 1920, when he was again taken with the same

old symptoms—chills, high temperature and sweats—but this time a little blood was found in the urine and the roentgen-ray showed two or three small calculi about the lower end of the left ureter, and rectal palpation detected hard nodules in the left seminal vesicle.

The diagnosis was made of calculi in the seminal vesicle, but it was thought best to examine the ureter as well. Under general anesthesia the same kind of incision was made as in the previous case and the ureter exposed behind the peritoneum and traced down to the bladder, where a hard mass was felt lateral to the ureter, on opening it two small calculi were removed from the seminal vesicle. The ureter was opened and explored both ways without finding anything abnormal. The wound in the ureter was closed with two fine catgut sutures.

Convalescence was uninterrupted, and he was discharged recovered, December 3, 1920, twenty-five days after operation. When heard from November, 1922, two years after operation, he was in good health and had had no further trouble.

THE SIGNIFICANCE OF PAIN IN THE BACK

By Robert Carothers, M.D.
Cincinnati, Ohio

A treatise of considerable size could be written quite easily from the above title, and perhaps much would be left unsaid. I have no intention so to inflict you. It is my hope to demonstrate a few back cases that when carefully studied can be taken from the malingering classes, and will be found to have a definitie cause and can be relieved in many instances by treatment. Pain in the back, like pain anywhere, is a reaction to irritation of nerves, caused either by direct pressure upon the cord or its nerve trunks, or indirectly reflected from elsewhere—the subscapular pain in gall-bladder disease, for example.

There are almost as many ways to induce backaches as there are cases—static strain or inequalities being one of the most frequent. The flat-feet and buck-knees are seldom without muscular and ligamentous strain in the back, and pain, which is relieved with proper treatment. Careful measurement of both legs in complaining patients will sometimes reveal one leg a half inch, perhaps an inch, longer than the other. A raised heel on the short leg usually proves the remedy to relieve a painful back in not a few people. In the listing spine, nerve trunks formerly pinched are now free.

A classification of frequent occurrence, probably the most frequent causes of back pain, is injury; not the severe injuries which are apparent and easily diagnosticated, but the so-called insignificant ones which are difficult to understand

and quite painful but not always disabling, especially in the beginning; requiring careful study and roentgen-ray aids and confirmations; drifting from one to another, labelled as a malinger and finally seeking relief anywhere, even in the hands of the cults.

The old railroad spine—very small fractures—cervical rib or sacralized fifth lumbar, and the much used and greatly abused sacroiliac synchondrosis. The best results have been obtained in such cases by very early recognition that an injury has occurred, recognized as of importance and given the best treatment—rest, long-continued rest—applicable to the individual case.

The diseases of the spine are any infections process that bone is heir to; acute or chronic, mild or severe. Again, it is the mild cases that try our own patience and our patients with pain in the back. In diseases of the spine, pain may be a blessing. It is the incentive to study the case, and an early diagnosis is so essential to success, is not infrequently made long before destruction occurs and treatment is given a chance to succeed.

The most pitiable conditions causing pain in the back are neoplasms—most frequently a secondary cancer to one in the breast. Under such cases it would seem justifiable to follow the advice of some of our peers, namely, a severance of the cord above the neoplasm.

DISCUSSION

Dr. E. Denegre Martin, New Orleans, La.—I am sorry the essayist did not lay more stress on sacroiliac sprains, as they are quite common. These back injuries need a more thorough examination than they have heretofore received, and if one point is borne in mind in the history of the case, it will clear up the diagnosis, namely, that sacroiliac sprain cannot occur unless the pelvis is fixed. The leg and the pelvis must be fixed, otherwise it is impossible to dislocate the sacroiliac joint.

Street-car and railroad injuries generally occur when a man is in a sitting position. In such a position the injury is not likely to occur.

In these cases patients complain of a great many reflex pains. I have never had a case in which the pain extended beyond the shoulder. There may be pain in the hip radiating down the leg. (It is important to fix them long enough for the sacrum to be held in position, otherwise they will recur.)

One of the last cases I had was a young man who, in attempting to help a young lady across a gutter, was held back by her as he stepped across. He was in such a position that the upper portion of his body twisted around, with one foot on each side of the gutter. He felt little discomfort at the time, but the next day could hardly walk. As to pains in the back, many of these come from some deformity. Patients give a history of sustaining an injury by being struck in the back, but usually there is no dislocation with it. These cases can be cured by sufficiently long fixation and a properly fitting belt.

One more point: In examining these cases it is necessary to put them on a platform and examine them carefully. You must get perfect alignment. In the chronic back cases there may be shortening of one limb. I had a woman under my care who suffered intensely; she was forty years of age. The pain got worse and worse. Examination revealed a congenital shortening of three-quarters of an inch in one leg. That means very little in youth where we have flexible cartilage, but when these patients get older and get stiff the condition must be corrected. It is necessary to put them on a measuring block, jack them up and get alignment, otherwise you will overlook the trouble. The shoe is raised to the proper height and relief is rapid.

Dr. Walter C. G. Kirchner, St. Louis, Mo.—I wish, in a measure, to continue the discussion of the previous speaker (Dr. Martin), with special reference to those cases that were roentgen rayed and showed very little.

I have had cases to handle after osteopaths, chiropractors, and the family physician failed, and it was up to me to see what I could do. There has been no explanation apparently why these patients have such excruciating pain and why they suffer as they do. I have one patient in mind who recently came to thank me for what I had done. In riding on a street-

car he had to stand; he could not bend and had pain shooting down the leg. Even in bed he could not roll over without great pain, yet nothing could be demonstrated. I felt perhaps there might be some systemic condition. A Wassermann was made and found negative. He had been under treatment for sinus trouble. Further investigation showed he had diseased teeth and the dentist thought they should come out. He was referred to a specialist for sinus trouble, and it was also found that he had infected tonsils. These were removed. His condition was getting worse, so that he had to be removed to the hospital. I put him under an anesthetic, manipulated the joints and back as well as I could, put him in a cast which made him comfortable and finally the pain disappeared. Later he was put in a jacket. I think two things in the treatment contributed to the relief in this case, the removal of the focus of infection and complete rest and support.

There is another type of case: I was called to see a patient for the purpose of removing his kidney He had pain in the back which came on suddenly. He was a young man. His back was painful and stiff. He was given rest treatment and in the course of three months he was cured. The point the doctor made of rest and support with a cast is a good one.

Dr. Carothers (closing).—I fully realize that I have tried to cover a large field in a short time. Most any one phase of the subject I have discussed would do for a paper of itself.

With reference to the remarks of Dr. Martin regarding sacroiliac joints we do not lay as much stress on the sacroiliac joint troubles as we formerly did. We formerly made a diagnosis of sacroiliac trouble, but we do not stop there. When one realizes the importance of the lumbar plexus of nerves, it does not take much to produce a lot of pain when they are in any way involved.

As Dr. Kirchner has pointed out, in some of these patients the poison has invaded the system. Let us take severe sacroiliac cases and we will find that a large dose of salicylate of soda will relieve the pain for some time, and that gives you a clue to find out what is the trouble. The main thing in a back pain is to find out what is the trouble. Sometimes you can do so and sometimes you cannot. In some cases the trouble is not in the back but somewhere else. There is nothing that requires so much general careful search sometimes as a

pain in the back. You may hunt all over the body and cannot find the particular focus of trouble, and then you may find the pain is due to some obscure trouble. Absolute rest is the thing for pain in the back. If you put these patients at rest for a long time, you can put them in a plaster cast and afterward in a jacket; and if you do this you can get them back to work and they can go on with their business and feel very comfortable.

REPORT OF A CASE OF RANULA, WITH COMMENTS ON THE THOMPSON THEORY OF ORIGIN[1]

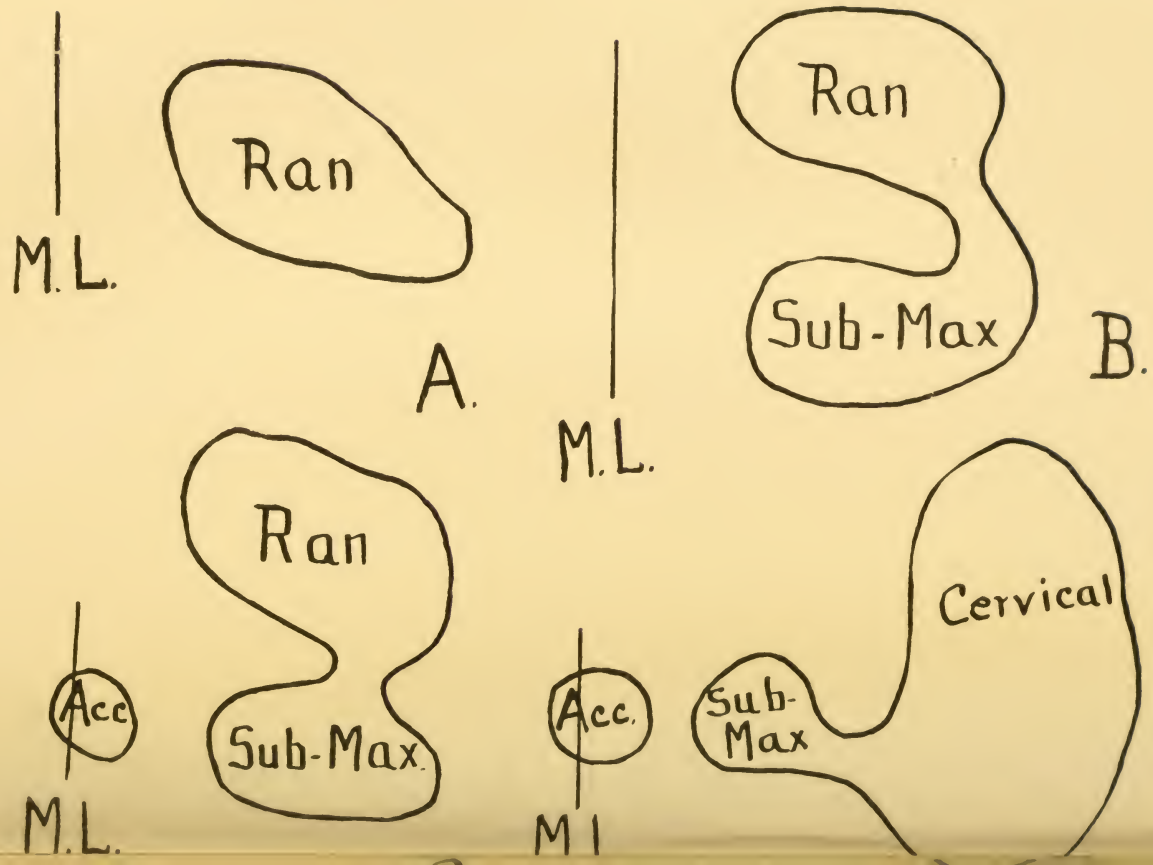
By V. P. Blair, M.D.
St. Louis, Mo.

I present a single case of ranula chiefly because of the opportunity to reopen the discussion of Dr. James E. Thompson's theory of origin which he presented before the American Surgical Association in 1920.[2]

There is no commonly occurring instance of abnormal anatomy about which such vague theories are prevalent. The mucoid cysts that occur in and about the floor of the mouth can be roughly divided into two classes. There are a number of different kinds of relatively small cysts that appear to lie in, or just under, the mucosa of the floor of the mouth or under the surface of the tongue, which tend to protrude frankly into the mouth; they are, in my observation, comparatively rare, small in size, and their complete excision is a simple matter. These have origin from various mucous or submucous glands, and their chief surgical interest comes from the confusion that has arisen from not drawing a sharp distinction between these and the more common type of ranula which lies in the floor underneath the mucosa and submucous tissues and whose chief char-

[1] From the Surgical Department of Washington University Medical School.

[2] The Relationship Between Ranula and Branchiogenetic Cysts, Annals of Surgery, August, 1920. (See this paper for a lucid explanation of the manner and cause of this migration.)


M.L.
Ran
A.
M.L.
Ran
Sub-Max
B.
Ran
Acc
Sub-Max
M.L.
Acc.
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Cervical
Sub-Max

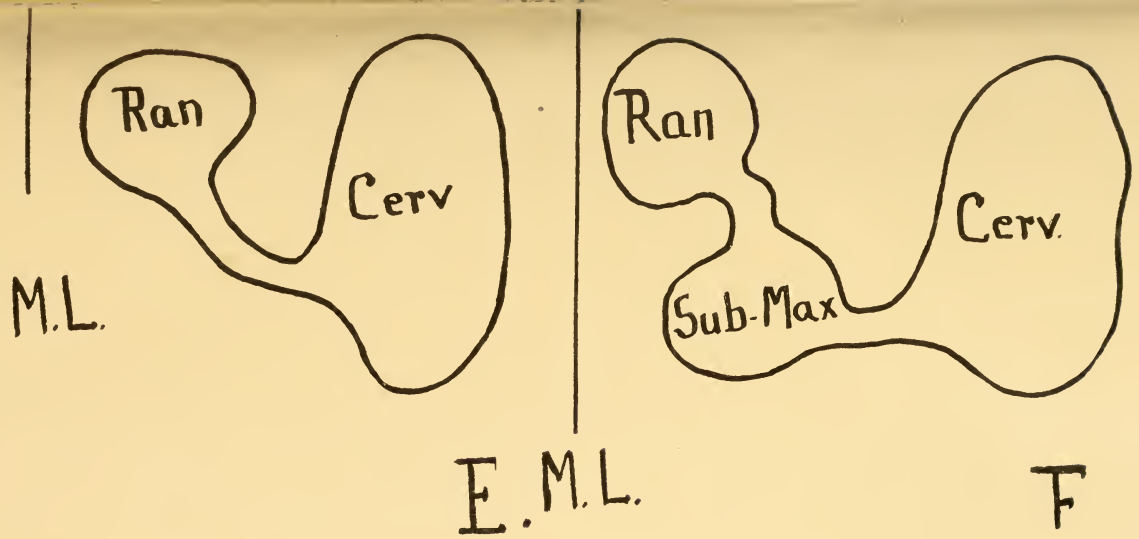

Fig. 1.—Doctor Thompson's original diagram, to illustrate the origin of the various types of deep ranula that he observed and which led him to conclude that these were all derived from the cervical sinus. A diagrammatic representation of the anatomical distribution of the cysts met with in the deep cervical, submaxillary and sublingual regions. A, represents a simple ranula. B, a ranula and submaxillary cyst communicating with one another by a neck. C, a ranula and submaxillary cyst communicating with each other; also a small isolated cyst in the submental region. D, shows a deep cervical cyst communicating with a submaxillary cyst; also an isolated submental cyst. E, shows a deep cervical cyst communicating with a ranula by a long narrow neck which traverses the submaxillary region. F, shows a deep cervical cyst communicating with a submaxillary cyst, which in turn opens into a ranula. The letters M. L. mean "middle line of the neck." For purposes of comparison all the cysts have been drawn on the left side of the body.

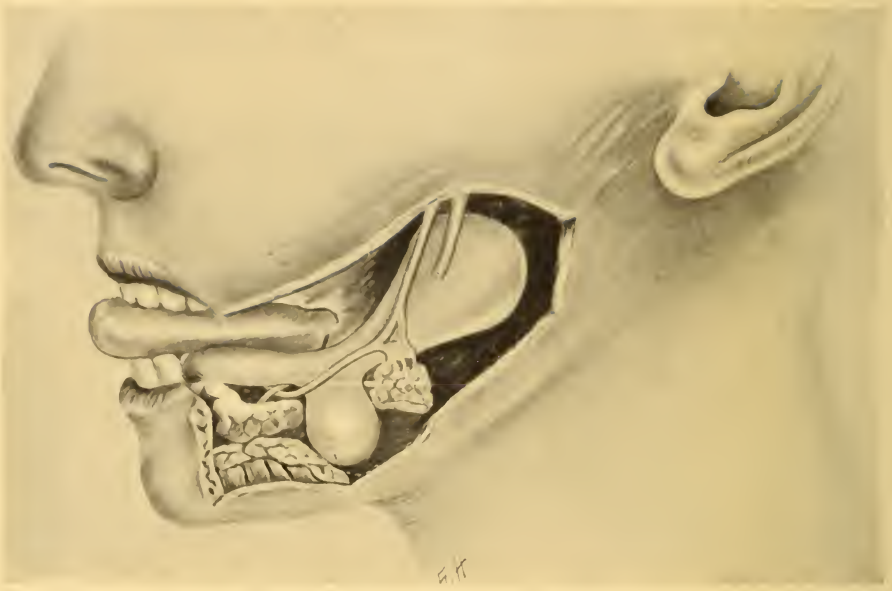

Fig. 2.—Is a semi-diagrammatic drawing of the relations found in the case here reported. It is from sketches made at the time of operation. The greater part of the submaxillary salivary gland lay superficial to the submaxillary extension of the cyst and was removed as a preliminary step in exposing the cyst. It will be noted that there is a constriction at the neck of the submaxillary cyst, bounded posteriorly by the "U" shaped bend of the gland as it turns forward with the first part of Wharton's duct. Normally this "U" bend embraces the posterior free border of the mylohyoid muscle, but here the muscle is pushed well forward by the cyst. Externally the neck is bounded by the submaxillary gland and the lingual nerve, and internally by Wharton's duct. Anteriorly it is sharply constricted above by the lingual nerve which has turned to run under Wharton's duct, and below this by the posterior border of the mylohyoid muscle. It is conceivable that part of the cyst might be pinched off to form the submental cyst sometimes found. The older theory was that submental ranula arose from an extension of the sublingual gland through the mylohyoid muscle. The parafaucial part here shown extending upward deep to the lingual nerve did not have the attachment to the base of the skull that was observed in our other cases and it was dissected out intact. In this illustration the internal pterygoid muscle has been omitted. In removing the forward oral prolongation, it was found attached at one point to the upper surface of the sublingual salivary gland in the typical manner that has, I believe, been the chief basis for considering this type of ranula to be a cyst of the sublingual gland.

acteristic is what Dr. Thompson has called a burrowing quality. These may push the tip of the tongue and the mucosa of the floor upward and backward, but the greater bulk always lies buried deep in the tissues of the floor. The amount discernible from within the mouth is no indication of its real size, and their complete removal may be very difficult or even surgically impracticable. The most commonly accepted hypothesis has been that such were obstruction cysts of the sublingual gland. This presupposes a unique reaction to sublingual obstruction, and such an explanation for submaxillary, submental and parafaucial ranulæ seems still more unreasonable. I believe that the theory of obstruction of the submaxillary duct or dilatation of a Fleishman's bursa can be dismissed without comment.

Dr. Thompson's hypothesis, that the deep ranula and related cysts originate from migrated positions of the cervical sinus, is sufficiently broad to explain all hitherto observed types. I have come to accept his view, not so much because it may or may not be correct, but because it furnishes a logical basis for adequate surgery. When you attempt to attack a ranula from within the mouth and find that it extends up to the base of the skull as a parafaucial cyst, as happened in two of our cases, or that a process extends an indefinite distance into the neck, as happened in another, or find the ranula to have a submental extension—then, thinking in terms of the sublingual gland or any other intraoral structure, will not give the key to this surgical puzzle. If, however, you accept even tentatively Thompson's cervical sinus hypothesis, you will then be better prepared to attack the cyst either from within the mouth or through a submaxillary incision, or both.

The case upon which I will hang this discussion is of a woman, aged thirty-four years, who complained of a swelling which appeared on the left side of the floor of the mouth, about two years ago. The swelling had been lanced repeatedly and "white of egg" material liberated, but for

the last few months she has not noticed it. About two months ago the swelling appeared in the floor of the mouth on the right side; this had also been opened and had reappeared.

At examination, on the left side, in the anterior submaxillary region, she had a swelling about 2 cm. across, which could be seen but hardly felt except when she swallowed. When she swallowed it became very tense and prominent and could be felt. Bidigital palpation of the floor of the mouth was negative anteriorly. Posteriorly in front of the fauces there was an indistinct fulness, but pressing on this point with one finger and on the tumor in the submaxillary region with the other a distinct sense of fluctuation could be obtained. On the right side she had a typical ranula extending from the midline and apparently lost posteriorly in the neighborhood of the first molar tooth.

On operation, under 2 per cent novocaine block of the lingual and inferior dental nerves of the left side and 0.5 per cent infiltration of the submaxillary skin, an incision was made from just below the angle of the jaw to the middle of the hyoid bone. On drawing the submaxillary gland upward and backward a cyst appeared anteromesial on the gland. It protruded from the floor of the mouth behind the posterior edge of the mylohyoid muscle, which was pushed forward in its normal position. The submaxillary gland was removed, excepting a little piece at the junction of the duct. The lingual nerve was adherent external (superficial) to the cyst, with the branch to the submaxillary ganglion also crossing the cyst. The submaxillary branch was cut and the lingual nerve dissected from the cyst except possibly in one place, where it was encapsulated in the wall of the cyst. The cyst was dissected free from the hyoglossus muscle, from the inner surface of the internal pterygoid muscle and from the wall of the pharynx; also from the upper surface of the mylohyoid muscle almost to the

midline. A hole was made in the mucosa of the mouth near the first molar tooth. The mouth was opened and the cyst and Wharton's duct brought into the mouth through the opening in the mucosa. The mucosa of the floor was incised anterior to this opening as far backward as the midline, and the cyst, Wharton's duct and the sublingual gland were removed in one mass. The wound was lightly packed and the skin approximated with horsehair. Free drainage was used. It was found on completion that the right-sided ranula had emptied itself, and it was not disturbed at this time.

DISCUSSION

Dr. J. Garland Sherrill, Louisville, Ky.—Dr. Blair has brought up a subject which is interesting because of the confusion in nomenclature which makes discussion of some of these conditions somewhat lacking in clarity. Confusion in this type of surgery exists largely because there is no distinct understanding on the part of the profession as to what the term ranula covers. In the neck certain cysts form as the remains of the branchial clefts and are usually described under the term hygroma. These are different from the so-called ranula which develops from obstruction of the submaxillary or sublingual glands, and if you bear that in mind, it will clarify the condition greatly for the surgeon.

Thompson has referred to these cases developing from the branchial clefts. The centrally implanted cysts which we see more or less in the submental region under the tongue are usually due to tubular closure of the thyroclossal ducts. In other parts we have hygromata and they occur in different regions where the clefts existed and are congenital remains. The ranula is due to obstruction of the submaxillary and sublingual ducts, and is frequently accompanied by superficial constriction which partially obstructs, giving rise to secretion within and retention and is less difficult to remove. Hygroma is difficult to remove and requires wide dissection, and in many instances it is best to leave it alone.

VERY LARGE RENAL STONE: NEPHRECTOMY

By J. Garland Sherrill, M.D.
Louisville, Ky.

This case is interesting in the main because of the size of the stone and the presence of two small stones in the opposite kidney, also on account of its long existence without serious inconvenience, the patient reporting for observation only after the infection began to affect her general condition. This latter caused a loss of ten pounds in weight in the course of six months.

The patient presented briefly the following history: Nothing of moment in the family record. She has been in fair health since she reached womanhood, except for an operation for hemorrhoids and fissure seven years ago, until present illness. Menstrual history without incident. One child born twenty-four years ago. Menopause four years ago accompanied by general weakness, nervousness and some indefinite stomach trouble. These symptoms persisted and were considered by the patient as incidental to the menopause.

For eighteen months the patient has suffered from constant pain of moderate severity in the right abdomen. This has been intensified during the two weeks prior to her admission to the hospital, and has been accompanied by scanty urine, with nocturnal frequency of about twice each night. There has been a constant pain in the right leg for four weeks. A similar attack confined her to bed for about two weeks in July of this year. She has suffered from little headache and in general has been able to be up and about her housework, though a more or less constant sufferer in a mild degree.

Large renal stone.

Her temperature on entrance was 98.6°, pulse and respiration normal. The urinary secretion was about 30 to 40 ounces daily. Renal efficiency within the limits of safety, as shown by the phenolphthalein test, 60 per cent. Urine: specific gravity, 1010, with albumin and pus present; no crystals or epithelium. The left kidney was carrying the entire function and its urine contained no albumin or pus. Pyelography was not done because the diagnosis was accurately confirmed by the roentgen-ray. One large stone was shown in the pelvis of the right kidney and two small ones in the left.

On October 7, 1922, she came to operation with clinical diagnosis of calculous pyonephrosis, which was performed in the usual manner through the lumbar route. The question for consideration before operation was the advisability of removing the hydronephrotic kidney on the right side, while two small stones were present in the pelvis of the left or better kidney. It usually has been held that better results obtain from removal first of the smaller stones from the kidney secreting the greater portion of the urine, the contention being made that by this procedure the efficient portion of the damaged kidney can be utilized to aid in secretion during the recovery from the pyelotomy on the good side. Then after recovery takes place the badly damaged kidney may be safely removed without fear of renal insufficiency or suppression. In this instance, after a careful consideration, it was decided to remove the badly damaged kidney and relieve the presenting disability first, because of the small size of the stones on the left side and because this kidney seemed to be carrying on almost all the renal function, and chiefly on account of the infection present in the right renal pelvis.

Up to this time we have had no reason to regret our decision. So far the patient presents no discomfort from the condition of the left kidney.

The output of urine after operation was as follows:

1st twenty-four hours	11 ounces.
2d twenty-four hours	19 "
3d twenty-four hours	23 "
4th twenty-four hours	24 "
5th twenty-four hours	35 "
6th twenty-four hours	38 "
7th twenty-four hours	46 "

Subsequently the amount ranged at 36 to 48 ounces as an average. For the first few days the urine contained some pus and some crystals of sodium urate and uric acid, but it improved rapidly, and when she left the hospital the urine was clear and free of sediment.

Gross Description. Specimen consists of kidney, 185 × 100 × 78 mm., somewhat lobulated, smooth, varying from pinkish to pale purplish gray, and contains few scattered fibrous tags. Fluctuates and masses resembling stones are palpable beneath the surface. Pelvis yellowish gray and contains calculi which extend into the kidney substance.

Cut surface shows cavities 11 to 60 mm. in diameter, which are separated by septums varying from 2 to 4 mm. in thickness. Extending upward into the kidney from the pelvis is a somewhat pedunculated stone, 89 × 54 × 49 mm., brownish to yellowish-gray, irregular and slightly rough; weight of stone 85 gm.; no parenchymatous tissue remaining. Weight of shell of kidney, 235 gm. Gross Diagnosis: (1) Pyonephrosis; (2) renal calculus. (Signed by Dr. Stuart Graves.)

Present Condition. Present condition is most satisfactory; the urine contains no albumin, blood, pus or crystals, and she has regained her usual weight. She has been carefully instructed as to diet and habits and will remain under observation until something is done for the relief of the two smaller stones in the left pelvis.

This case emphasizes the contention so often made for

the early removal of stones in the renal pelvis, kidney or ureter, because of the damage done to those structures by their long-continued presence. There is possibly no pathological condition in which the diagnosis can be made with more accuracy or in which relief can be provided with more certainty than is possible in urinary calculi. There is, however, more difficulty in providing a treatment which will prevent their recurrence, and very careful attention to diet, the ingestion of large quantities of water and properly directed exercise should be advised by the attendant.

INVAGINATION OF THE CAPUT COLI OF MANY YEARS' DURATION

By J. Garland Sherrill, M.D.
Louisville, Ky.

Failure to observe hitherto a case of chronic invagination of the cecum, notwithstanding the comparative frequency of acute intussusception, led to the presentation of this report. An apology should be made because its recognition occurred only at operation for another affection. This may be explained in part by the lack of symptoms directly due to the invagination during recent months, and in part because of the fact that the operation was done in an emergency in an adjoining city for an acute attack of cholecystitis, gallstones and acute distention of the gall-bladder. The latter condition had been recognized by the attendant, but his attention had not been directed to any intestinal lesion. The abdomen was much distended and tender, so that at my examination only the distended gall-bladder was detected, while the mass in the colon was not felt. There was, however, sufficient mention of intestinal prolapse in the previous history to have caused more consideration of this possibility than was given it.

A young woman, aged twenty-one years, married two years, mother of two children, came under observation June 22, 1922, giving the following history: She had jaundice at the age of five, recovering in a short time. At seven years she was very ill with abdominal pain of cramping nature and marked distention; constipation existed for a

Invaginated colon, mucosa external—pointer in lumen of remnant of small gut. Small dark spot near large extremity of mass is site of orifice of appendix.

time, followed by diarrhea and bloody stools. For a time she passed pure blood. Her mother described her stools as very offensive, like something rotten or decomposed. She became much emaciated, then began to improve, and in March, 1908, a mass of intestines protruded through the anus for twelve or more inches, which was replaced by her attendant after twenty-four hours. She suffered from diarrhea up to the age of thirteen, then had habitual constipation. In 1916 she once more had a massive prolapse, which was again replaced by her attendant without anesthesia. She still had a constipated habit until the present time, always requiring a purge or enema. While pregnant she had two attacks of gallstone colic, pain being very severe, with mild fever, each attack lasting about one week. On June 17, 1922, she was seized with severe pain in the upper right quadrant, nausea and vomiting, accompanied by jaundice.

On June 22, 1922, she came to operation for acute distention of the gall-bladder, cholecystitis and stones. The gall-bladder was found to be greatly distended, its walls thickened and inflamed, containing a quantity of mucopurulent, bile-stained fluid and a number of gallstones.

Owing to the previous history, the right lower quadrant was examined, and in picking up the transverse colon a mass was palpable within it which felt like an arm within a sleeve. This impressed us as a fleshy mass rather than a hairball or concretion. The transverse colon was opened and a mass was withdrawn, pyriform in shape, attached by a narrow pedicle to the colon near the hepatic flexure. This mass was 24 cm. in length, covered with mucous membrane, and was apparently the inverted caput coli. Near the distal or large end was a small opening, evidently the ostium of the appendix, extending from which the cord-like appendix could be felt beneath the mucosa. About 4 cm. above this opening was another of larger size, about 12 mm. in diameter, marking the extremity of a canal 8 cm.

in length, lined inside with serous membrane and on its surface with mucous membrane, probably being the remains of the ileocecal valve and a portion of the ileum left after the sloughing process had completed its separation and formed a new ostium from the ileum into the colon. After determining the absence of any intestinal lumen within this mass, it was tied off and excised and the wound in the colon sutured. She made a very satisfactory recovery from the operation and expressed herself as being able to have a bowel movement without taking medicine for the first time since she was ill as a child. Her weight previous to operation was 113 pounds; present weight, 130 pounds, a gain of 17 pounds. On December 6, 1922, her general condition shows much improvement.

WHITE BILE IN THE COMMON DUCT

By E. Starr Judd, M.D.
and
John H. Lyons, M.D.
(By invitation)
Rochester, Minn.

The term "white bile" is a misnomer; it is applied to the colorless liquid occasionally found in the obstructed common and hepatic ducts. Although the gall-bladder often contains a colorless liquid, such a liquid is only rarely found in the common and hepatic ducts. The origin and nature of this so-called white bile have long puzzled surgeons, but it has been quite generally believed that its presence indicates greater operative risk.

Kausch in 1911 reported in detail a case of "white bile" in which he had operated, and reported 13 other cases which he had collected from the literature. In none of these 14 was the obstruction due to stone, and Kausch believed it unlikely that obstruction by stone would result in white bile. From a study of these cases he concluded that white bile is a secretion of the mucosa of the biliary passages which occurs with obstruction when the secretion of the mucosa of these passages is greater than its resorption. The biliary passages then become distended and the pressure in them gradually rises. When a certain point is reached, the direction of the flow in the liver is reversed, that is, the bile formed by the liver cells and the bile in the passages pass into the lymphatics and blood-vessels. As a result of this and the continued secretion of a colorless fluid by the mucosa

of the biliary passages, the liquid in these passages becomes lighter and lighter, and finally colorless. Kausch recommended cholecystenterostomy for the condition.

In 1921 Rous and McMaster succeeded in producing white bile experimentally. They proved that it is the secretion of the mucosa of the biliary passages and occurs in obstructed ducts which are not connected with a functioning gall-bladder, that is, a gall-bladder which is concentrating its contents by absorption. In the dog and cat the common duct is formed from three or more main hepatic branches, high in one of which the gall-bladder empties. In several cats and dogs, and in one monkey, obstruction of the common duct, or of one or more of its hepatic tributaries, was produced in such a way that the gall-bladder still communicated with the channels in stasis. The stasis bile found later was heavily pigmented and syrupy, ropy or tarry, according to whether the period of obstruction had been long or short. In several dogs, cats and monkeys the common duct and the neck of the gall-bladder were obstructed or one or more large hepatic ducts were tied and cut separately. The stasis fluid in these cases was at first brown, then green, but definitely less pigmented, and finally after ten or more days of stasis, became clear and often completely colorless. In several dogs a portion of the common duct was isolated by ligating and cutting it above and below. At various periods up to twelve days the animals were chloroformed and examined. The isolated segment was found uninflamed but greatly distended in every case, and contained colorless, watery or mucinous fluid, identical with that mentioned. All of the animals had become jaundiced, but none of the duct fluid was bile-stained. Cultures of this fluid were negative.

Berg, in 1922, in his monograph on the biliary system, expressed the opinion that white bile must be due to some cause other than obstruction, as, in a large number of cases, a similar obstruction produces dark, concentrated bile.

In the last four years 649 operations have been performed on the common or hepatic ducts at the Mayo Clinic. In this group were 19 in which white bile was present; in 9 of these the obstruction was due to stone in the common or hepatic duct and in 6 to trauma at a previous cholecystectomy; in 2 the obstruction was due to carcinoma (1 of the pancreas and 1 of the ampulla) and in 1 it was due to pancreatitis. In 1 case the white bile seemed to occur as a result of cholangitis.

The 9 cases of white bile due to obstruction by stone in the common duct occurred among 361 cases of stone in the common duct, an incidence of 2.4 per cent. The 6 cases due to stricture occurred among 33 cases of complete stricture, an incidence of 18 per cent. The 2 cases in which the obstruction was due to carcinoma occurred among 108 cases of carcinoma of the pancreas and ampulla, in 1.8 per cent. The incidence in pancreatitis was not determined, as in most such cases there is no obstruction of the common duct.

17 of our patients were intensely jaundiced at the time of the operation, and there had been no recent decrease in the jaundice. 1 patient who was not jaundiced had a fistula, but at operation, retained colorless bile was found. The second case without jaundice presented interesting features. The patient had been having attacks of gallstone colic for six months, but had not been jaundiced until the last attack, which was three weeks before operation. He had only a moderate degree of jaundice, and it had lasted only a few days. At the time of operation there was no trace of jaundice and no bile in the urine. At operation the gall-bladder was found to be greatly distended, and there was a stone in the common duct beneath the pancreas, completely blocking the duct, which contained only clear, watery fluid. Curiously the patient was not jaundiced as a result of the complete obstruction to the duct. The stone was removed and the opening in the common duct closed. The gall-bladder was removed and a tube stitched to the stump of the cystic duct.

On the fourth day drainage of bile started. The patient left the hospital in good condition on the twenty-third day after operation, but died nine days later. At necropsy acute hemorrhagic pancreatitis was found. The absence of jaundice with complete obstruction must have been due to the fact that the liver was no longer secreting bile, probably a very unusual occurrence.

It is not definitely known how quickly the contents of the common and hepatic ducts can become colorless. In our series of cases the shortest period of continuous jaundice before operation was two weeks; the longest period was one year; the average duration, sixteen weeks.

As we have mentioned, Rous and McMaster proved experimentally that white bile occurs only when the obstructed ducts are not connected with a normally functioning gall-bladder. 7 of our patients had had cholecystectomy elsewhere, 6 of the remaining 12 were found to have marked cholecystitis at operation; 2 had acute empyema of the gall-bladder; 1 had a completely cicatrized gall-bladder; and 3 had greatly distended gall-bladders, in 1 of which were multiple stones. None of our patients had normal gall-bladders; in other words, they bear out the conclusions which Rous and McMaster made from their experimental work.

One case was very unusual. The gall-bladder contained green, watery material, while the common duct contained fluid which showed no trace of bile. The patient had been having gallstone colic at intervals for a year, but had been jaundiced only two weeks. At operation marked cholecystitis was found. The common duct was twice its normal size. The glands along the ducts were greatly enlarged. The explanation is that the gall-bladder was cut off from the common duct by the inflammatory process and the contents of the biliary passages became colorless before hydrops of the gall-bladder could be produced. A cholecystostomy and choledochostomy were performed. 120 c.c. of bile drained the first twenty-four hours, 330 c.c. the next twenty-four hours,

and 180 c.c. the next twenty-four hours. Bile appears in the ducts after drainage is extablished in a remarkably short time. In our cases, in which drainage was established to the outside, bile appeared in the first twenty-four hours in all except 1. This is the patient who had complete obstruction without jaundice. The bile did not drain until the fourth day. The common duct of 1 patient contained only colorless fluid; cholecystectomy and choledochotomy were performed, and at the close of the operation the drainage was bile-stained.

Hepaticoduodenostomy was performed in 1 case; choledochostomy in 8 cases; cholecystostomy in 3 cases; cholecystostomy and choledochostomy in 4 cases; choledochostomy and cholescytectomy in 2 cases; and cholecystectomy with a tube sutured into the stump of the cystic duct in 1 case. In the 19 cases there were 4 operative deaths, an average mortality of 21 per cent. 1 patient died of acute hemorrhagic pancreatitis after leaving the hospital, which is not considered here as an operative death. 1 of the patients who died had had cholecystostomy; the remaining 3 had had choledochostomies. Postmortem examinations were obtained in 3 of these cases. In 2, about 500 c.c. of blood was found in the peritoneal cavity; this was not sufficient to explain death, as both patients had been transfused after the operation. The bleeding was an oozing from all surfaces and not from any one blood-vessel. 1 of the deaths was probably due to shock caused by the sudden release of pressure in a completely obstructed bile duct; the other 2 were probably due to insufficiency of the liver. The fourth patient probably died of insufficiency of the liver and uremia. Necropsy was not obtained, but the blood urea the day before death was 176 mg. for each 100 c.c. While the operative mortality was high in this group of cases, it is probably no higher than it would be in a series of cases of complete biliary obstruction of the same duration with green bile in the common and hepatic ducts.

Loss of weight was a striking feature in the history of these patients. Often it suggested malignancy. 1 patient whose obstruction was due to stone had lost 32 pounds in ten days, and a patient with a stricture had lost 61 pounds in one year. The average loss of weight was 28 pounds. The average duration of the jaundice was sixteen weeks.

It cannot always be assumed that white bile indicates that the liver is not secreting. In fact, in our series there was only 1 case in which the liver probably was not secreting bile. There are two reasons for believing that the liver does not necessarily cease to secrete bile; first, the elimination of bile in the urine would result in a decrease in the jaundice. 2 of our cases were not jaundiced; the others had a good deal of bile in the urine, yet there had been no decrease in the intensity of the jaundice. Second, if the liver had ceased to secrete bile it would hardly resume that function so rapidly after the establishment of drainage. As we have noted in 1 of our cases, the drainage from the tube in the common duct had become bile-stained by the end of the operation.

It is a well-known clinical fact that if bile does not appear soon after establishing drainage of the common duct in a deeply jaundiced patient the outlook is not good. 2 of our patients who did not recover had slight drainage of bile for the first few days, and then it stopped. 1 of the patients who recovered did not drain bile until the fourth day; it is possible that some of the bile was passing around the tube into the intestine, and yet no bile was found in the duct at operation. In view of what is known of a temporary cessation of function of other viscera, it seems possible that all hepatic function might be suspended for a time and still be entirely reëstablished later.

It is improbable that we shall ever be able to operate in this type of case without mortality. The patient who died of uremia and liver insufficiency might have been saved by the better preoperative treatment now in use. In our

experience most of the deeply jaundiced patients have uremic tendencies, as is shown by the high percentage of blood urea. This can often be corrected by increasing elimination.

We have seen what we have termed " liver shock" in certain cases of jaundice. It has seemed to come after sudden, complete and permanent release of pressure in the common duct. The fluid in the duct had been under great pressure and, as soon as the duct was opened, a great amount of fluid escaped immediately, filling the entire operative field. This reaction has occurred in cases in which the fluid in the duct was bile, and also in those in which it was white. The shock has usually come several hours after the operation when the immediate effects of the operation had apparently passed. Whether this reaction may be due to congestion in the hepatic tissue, caused by the sudden entrance of a large amount of blood into the vessels as a result of the sudden release of pressure in the hepatic ducts, we do not know. In cases in which the bile was under great pressure we have tried to release it gradually by suturing a tube into the duct, without allowing all of the fluid to escape, and clamping the tube as a control. The clamp is released for a few minutes at intervals for the first few days, in this manner gradually decompressing the liver. Just how much this will accomplish in these cases is uncertain. We have employed it a number of times and in each case there was complete freedom from reaction. The postoperative bleeding, so often seen formerly in these cases, seems well under control by proper preliminary methods.

Cases in which there is white or colorless fluid in the common duct represent a very serious surgical type. They are not, however, necessarily fatal, as the finding of this fluid in the duct does not mean that the liver is interfered with more than in any deeply jaundiced patient. The colorless fluid, or so-called white bile, is a product of the glands of the duct wall. It is secreted under sufficient pressure to

continue to form regardless of the secretion of bile from the liver, and it collects in the ducts only when the activities of the gall-bladder are destroyed.

REPORT OF CASES.

Case I (A260954).—Mr. G. M., aged fifty-one years, was examined February 20, 1919. Since August, 1918, the patient had had four or five attacks of severe pain in the right costal arch, referred to the back, and accompanied by nausea and vomiting, and residual soreness in the region of the gall-bladder. Moderate jaundice had accompanied the last attack, two weeks before. He had lost 6 pounds in weight.

Examination did not reveal evidence of jaundice. The urine contained albumin 1, but was otherwise negative. February 27, 1919, choledochotomy, cholecystectomy and appendectomy were performed. A rounded stone 2 cm. in diameter was found in the common duct under the pancreas; it crumbled during removal. The gall-bladder and common and hepatic ducts did not contain bile, but were filled with clear fluid. Pancreatitis 2 was noted. There were no stones in the gall-bladder, which was greatly distended. Although obstruction apparently was complete, the patient had not been jaundiced. A tube was sutured into the stump of the cystic duct. Bile did not drain until the fourth day, when 210 c.c. drained, and on the fifth, 180 c.c. The stools were colored after the operation.

The patient left the hospital the twenty-third day, and died the thirty-second from acute hemorrhagic pancreatitis.

Comment. This case is particularly interesting, first, because although the duct was apparently completely obstructed the patient did not have the ordinary clinical signs of jaundice. In view of the fact that there was no bile-stained fluid in the gall-bladder or ducts, it would seem that the obstruction of the ducts had been complete. We are unable to explain this unless the liver had ceased secreting

bile. It is further noteworthy that although the patient seemed to be in good condition after the operation, there was no sign of drainage of bile from the duct until the fourth day, when it gradually increased. The inflamed pancreas was noted at operation, but there was no evidence of hemorrhage into it or of fat necrosis. We are unable to explain how the patient could live for several days without liver function, and also why the pancreatitis, which apparently existed at the time of operation, did not clear up with drainage of the common duct.

Case II (A262802).—Mrs. P., aged twenty-nine years, had had a cholecystectomy performed elsewhere in October, 1918, because of soreness in the area of the gall-bladder and dyspepsia. As long as the bile drained the patient felt comfortable, but in January, 1919, the opening closed, and she became yellow and jaundiced. She lost 32 pounds in weight.

The patient was jaundiced at the time of the examination, and bile 3 was found in the urine. March 14, 1919, choledochostomy was performed. The common duct was distended and completely occluded. The patient died on the day of the operation. Necropsy revealed 500 c.c. of blood in the abdomen.

Comment. Because of the deep jaundice and complete obstruction the patient was recognized as an extreme risk. An attempt was made to establish the flow of bile through the duct, with the hope of making a plastic reconstruction later. Immediately after the operation the patient seemed to be in good condition. Within a few hours she showed signs of shock, such as has been observed on sudden release of pressure in a completely obstructed common bile duct. All possible efforts were made to correct this, without avail. A transfusion of 500 c.c. of blood was given.

Necropsy revealed nothing of significance except about 500 c.c. of blood in the peritoneal cavity. We believe, however, that such bleeding often occurs after operations

on jaundiced patients, and that it is not sufficient to explain the cause of death.

Case III (A294436).—Mrs. C. C., aged forty-three years, was examined October 24, 1919. She gave a history of having had gall-bladder disease since 1903. Cholecystectomy had been performed elsewhere in August, 1918. Two months later persistent jaundice had developed. The patient lost 25 pounds in weight in fourteen months.

Examination revealed jaundice and bile 2 in the urine. November 4, 1919, hepaticoduodenostomy was performed. There was complete obstruction of the hepatic duct at the site of the cystic duct. No bile, but about 200 c.c. of clear fluid was found in the ducts. The pancreas was normal. On the sixth day postoperatively there was slight drainage of bile from the wound and none thereafter. The patient left the hospital on the seventeenth day.

Comment. One point of interest in this case is that she had been continuously jaundiced for about one year, and was deeply jaundiced at the time of operation. At operation the liver was found to be greatly enlarged and there was complete obstruction of the common bile duct at the site of the cystic duct. The operation consisted of hepaticoduodenostomy, and while there was some drainage of bile to the outside on the sixth day, this stopped very shortly, and the wound healed in a short time. Apparently all of the bile that was being formed by the liver had been taken into the general circulation for a year, but as soon as the obstruction of the duct was relieved and the normal bile passage established the jaundice subsided readily.

Case IV (A307822).—Mrs. M., aged forty-four years, came to the Clinic March 2, 1920, with a history of having had gallstone colic three years. She was first jaundiced six weeks before. The jaundice had been continuous for two weeks. She had lost 33 pounds in weight.

At examination, jaundice grade 2 was noted. March 13, cholecystostomy and choledochostomy were performed. The common duct and gall-bladder were greatly distended and contained only mucoserous liquid. One stone was found in the common duct and one in the gall-bladder. The condition of the pancreas suggested malignancy. The patient left the hospital the eighteenth day and was dismissed from observation March 10, with bile still draining from the wound.

Comment. The gall-bladder and ducts contained a clear thick fluid. The day of the operation 45 c.c. of bile drained from the tube; the second day 300 c.c. drained; and the third 240 c.c. Apparently as soon as the clear fluid had escaped from the gall-bladder and ducts the bile began to flow.

Case V (A312770).—Mrs. F. K., aged forty-two years, was examined April 17, 1920. She had had gallstone colic for two years. Jaundice had appeared after the last attack, two weeks before, and had persisted.

Jaundice grade 3, and bile 2 in the urine were found on examination. May 12, cholecystectomy and choledochostomy were performed. A large stone was found impacted in the ampulla of Vater. The common and hepatic ducts also contained a number of medium-sized and small stones and thick mucus. At the close of the operation normal appearing bile was escaping from the drainage tube. The pathologist reported acute empyema of the gall-bladder with cholelithiasis and pancreatitis 2. 240 c.c., 300 c.c., and 300 c.c. of bile drained in the first three twenty-four hour periods respectively; no bile drained after the ninth day. The patient left the hospital the fourteenth day.

Comment. This case is of special interest in view of the fact that although the patient was deeply jaundiced the condition had been present for only a few weeks. At operation a complete obstruction of the duct by a stone at the ampulla of Vater was found, and although the duct

contained fluid which was not bile-stained, it emptied, and the bile started draining as soon as the obstruction was removed.

Case VI (A317871).—Mr. H. M. K., aged forty-nine years, was examined May 31, 1920. He had had gall stone colic for six years. Jaundice accompanied the last attack, which started nine days before. The jaundice persisted. The patient had lost 32 pounds in ten days.

Examination showed jaundice 3, and bile 3 was noted in the urine. June 7, partial cholecystectomy and choledochostomy were performed, and subacute cholecystitis, with one stone blocking the cystic common ducts, was revealed. The walls of the gall-bladder were not very thick, the common and hepatic ducts were dilated and the gall-bladder and common duct contained only a thin, watery secretion. 270 c.c., 300 c.c. and 270 c.c. of bile, respectively, drained in the first three consecutive twenty-four hour periods after operation. No bile drained after the fifteenth day. The patient left the hospital on the seventeenth day.

Comment. This case is of special interest to us because the stone which obstructed the common bile duct also completely obstructed the cystic duct and interfered with any functioning of the gall-bladder.

Case VII (A317760).—Mrs. M. K., aged fifty-six years, was examined May 31, 1920. She had had stomach trouble since girlhood, and gall stone colics with jaundice since May, 1919. Jaundice had been continuous for two weeks before examination. No loss of weight was noted. At examination bile 1 was found in the urine, but no bile in the stools. June 10, choledochostomy and cholecystostomy were performed, revealing a single stone in the common duct, which was dilated. There was no bile in the ducts, but the gall-bladder was contracted. 210 c.c., 210 c.c. and 360 c.c. of bile drained in the first three consecutive twenty-four hour

periods following operation. The patient left the hospital on the twenty-third day; at this time there was no drainage.

Comment. Clinically, this case represented the ordinary case of common-duct stone, and so far as could be determined there was no means of suspecting the presence of white bile. The clinical evidence of jaundice was not as complete as in some of the other cases, although the obstruction of the duct was complete. The flow of bile was established almost as soon as the obstruction was relieved.

Case VIII (A347053).—Mrs. G. W., aged fifty-six years, was examined January 21, 1921. She had had gall stone colic for four years. Cholecystectomy had been performed elsewhere September 29, 1920. and drainage of bile had persisted. December 7, 1920, an exploratory operation was performed, but the results were unsatisfactory, as the patient went into collapse on the table. Bile drainage persisted and the patient had lost 35 pounds in weight.

At examination jaundice was not evident, and there was no bile in the urine. Preoperative treatment was not given. January 31, choledochostomy was performed. There were multiple abscesses throughout the abdominal wall, the retained bile was colorless, and the hepatic duct contained stones. The drainage of bile increased with each successive twenty-four hour period. The patient left the hospital on the twentieth day. February 11, 1922, hepaticoduodenostomy was performed, but the patient died on the day of operation from hemorrhage.

Comment. In this case the white bile was the result of stricture formation, which completely obstructed the duct.

Case IX (A339670).—Mrs. M., aged fifty-five years, was examined November 2, 1920. For twenty-five years she had had attacks of severe pain in the upper abdomen, accompanied by chills and fever. Morphine was required for relief. Two years before, the patient became jaundiced, and this condition persisted in varying degrees for eighteen

months, then apparently disappeared for several weeks. Later it reappeared, accompanied by pain, and was still present at the time of examination. The patient had lost 65 pounds.

Examination revealed jaundice 3, with tenderness in the region of the gall-bladder, and albumin 3 with a trace of bile in the urine. The patient was sent home because of her poor condition, and calcium lactate was prescribed. She returned four months later, still jaundiced, and preoperative treatment was instituted. March 31, 1921, cholecystostomy and choledochostomy were performed, revealing cholecystitis with cholelithiasis and choledocholithiasis, biliary cirrhosis 3, pancreatitis 2. Moderate ascites was present, the liver was very large and the spleen could not be palpated. About 500 c.c. of gluey white fluid (white bile) escaped from the gall-bladder and common duct. Drainage of 180 c.c. of bile was noted the first day after operation, and the dressings were stained with bile 2. The second day 750 c.c. of bile drained and the third day, 420 c.c. The patient left the hospital on the twenty-ninth day, still jaundiced, with blood-stained bile draining.

Comment. This case is one in which the jaundice had persisted for a long time, and at the operation the gall-bladder and ducts were found to be greatly distended with a large amount of white bile. This is the only case in which ascites was present to any extent, and one of the possibilities is that the portal circulation may have been interfered with by pressure from the greatly distended bile ducts, as suggested by Kausch.

Case X (A354710).—Mrs. R. W., aged thirty-four years, was examined April 7, 1921. Cholecystitis had been present eight years. In August, 1920, a cholecystectomy was performed elsewhere. Jaundice appeared eight days after operation and was progressive. Forty pounds in weight were lost.

At examination the patient was jaundiced and bile 2 was found in the urine. A transfusion was the only preoperative treatment given. April 13, choledochostomy was performed. The common duct contained colorless bile; much scar tissue was noted. 45 c.c., 60 c.c., and 90 c.c. of bile drained in the first three successive twenty-four hour periods, respectively. The patient died on the fifth day after operation. Necropsy revealed intra-abdominal hemorrhage. Impaired liver function was probably the important factor in producing death.

Comment. This case emphasizes the risk of operating on deeply jaundiced patients. The patient, except for the jaundice, was apparently in fair condition. Operative procedures were no more than were necessary to reëstablish the biliary flow. As occurs in a great many of such patients who do not recover, only a very small amount of bile drained at any time, but the amount was sufficient to show that the ducts and tube were not obstructed. The intra-abdominal hemorrhage in this case amounted to 500 c.c. During the five days after operation the patient was given three transfusions of 500 c.c. each, which would more than offset the free blood in the peritoneal cavity.

Case XI (A357381).—Mrs. D. B. S., aged fifty-three years, was examined May 6, 1921. Pain had been present in the right upper quadrant for six months. The patient was first jaundiced twelve weeks before, and the condition persisted in varying intensity. The patient had lost 30 pounds in twelve weeks.

At examination jaundice 4 was noted, and bile 3 was found in the urine. May 15, cholecystostomy was performed and an abscess in the gall-bladder, containing 30 c.c. of pus was found and drained. There was marked biliary cirrhosis, and white bile escaped from the common duct. Stones were found in the common duct, and it was thought best to remove them at a second operation. The bile drained

freely. The patient left the hospital on the twenty-ninth day. August 6, 1921, a second operation, choledochostomy, was performed, at which time stones were removed from the common duct. The patient was dismissed from the Clinic August 25, 1921.

Comment. This case represents the value of the two-stage operation in cases in which the severity of the condition is recognized.

Case XII (A363696).—Mrs. J. D., aged fifty years, was examined July 5 , 1921. She had been troubled by gall-bladder disease and colic for one year. Stools had been white for the last six months, and the patient had been jaundiced for one week prior to examination. The only previous operation was a uterine suspension. 17 pounds in weight had been lost.

On examination the patient showed marked jaundice 3. Bile 2 was found in the urine, and preoperative treatment for jaundice was given. July 12, cholecystostomy and choledochostomy were performed. Portal cirrhosis, slight pancreatitis and very marked cholecystitis were noted. The gall-bladder was flaccid. The glands along the ducts were markedly enlarged, some green watery material was found in the gall-bladder, but no bile-stained fluid in the common duct, which was twice its normal size. The operator diagnosed the condition as cholangitis with cholecystitis. The drainage of bile in the first three successive twenty-four hour periods after operation was 120 c.c., 330 c.c. and 180 c.c., respectively. The patient left the hospital on the twenty-third day after operation. No bile had drained from the wound since the thirteenth day.

Comment. The explanation of the fact that there was bile-stained fluid in the gall-bladder and colorless fluid in the common duct must be that the ducts and the gall-bladder were separated by obstruction. This is the only case in which we were unable to determine the exact cause of the

obstruction of the bile duct. It may have been due to the pancreatitis or the enlargement of the lymphatics. Although there was no bile in the common duct at the time of operation, it nevertheless appeared from the drainage tube very shortly afterward. The patient was clinically well and the wound healed normally in the ordinary length of time.

Case XIII (A365515).—Mrs. M. C. B., aged sixty years, was examined July 21, 1921. Five months before, she had had a chill and fever with vomiting, followed by jaundice, which persisted. She had lost 17 pounds.

At examination jaundice 3 was present. July 30, choledochostomy was performed. The gall-bladder was contracted, and a stone and white bile were found in the common duct, which was dilated and completely cicatrized. Biliary cirrhosis 3, enlargement of the liver 3, and pancreatitis 1 were noted. The dressings were bile-stained the first day. 195 c.c. and 300 c.c. of bile drained in the second and third twenty-four hour periods following operation. The patient left the hospital on the fifteenth day. No bile drained from the wound after the thirteenth day.

Comment. While this case is clinically one of painless jaundice, the cause of the obstruction of the common duct was a stone. The obstruction must have been complete, in view of the fact that there was no bile in the duct at the time of operation. The gall-bladder was apparently completely destroyed by inflammation. The jaundice cleared up after drainage, so that it was evidently not the result of cirrhosis or pancreatitis.

Case XIV (A371864).—Dr. H. B. A., a man, aged fifty-six years, was examined September 12, 1921. He had suffered from gall-bladder disease for two years, and had lost 16 pounds. He was jaundiced for three days before coming to the Clinic.

Examination showed jaundice with bile 3 in the urine. Preoperative treatment was given. September 27, chole-

cystostomy was performed. One stone was found in the gall-bladder, the walls of which were thick. The common duct was greatly dilated and contained clear fluid. Obstruction of the common duct at the head of the pancreas, pancreatitis 3, and moderate biliary cirrhosis were noted. 60 c.c., 120 c.c. and 270 c.c. of bile, respectively, drained in twenty-four hour intervals following operation. The patient left the hospital on the ninth day. The last dressing was removed October 19, at which time bile drained from the wound.

Comment. This case represents one in which swelling in the pancreas as the result of inflammation may have been sufficient to produce complete obstruction in the common duct. The inflammation apparently originated in the gall-bladder, which contained one stone, and very probably extended from there to the pancreas. We believe that the pancreas seldom becomes involved in inflammation to the degree of producing complete obstruction of the common duct, but undoubtedly it occurred in this case.

Case XV (A388643).—Mr. E. G., aged fifty-seven years, was examined November 18, 1921. He had had pain in the upper abdomen with fluctuating jaundice for six months.

At examination jaundice 2 was noted, and preoperative treatment for jaundice was given. December 1, cholecystostomy was performed. White bile and stony fragments were found in the distended gall-bladder and common duct. Pancreatitis 4 and biliary cirrhosis 3 were also present. The drainage of bile in the first three consecutive twenty-four hour periods following operation was 980 c.c., 1600 c.c., and 1650 c.c., respectively. The patient died on the ninth day from insufficiency of the liver. Necropsy revealed carcinoma of the head of the pancreas.

Comment. Complete obstruction of the duct with formation of white bile in this case was due to carcinoma of the head of the pancreas. Death was probably caused by liver insufficiency and malignancy in the pancreas.

Case XVI (A242658).—Mr. G. E. W., aged fifty-one years, was examined March 28, 1922. He had had stomach trouble for fourteen years. Eight and one-half years before, he began to have attacks of sudden pain in the epigastrium with bloating, and residual soreness requiring morphine. Recent attacks of pain localized in the right costal marginal area and were accompanied by chills and fever. Jaundice occurred with the last attack and persisted in a varying degree. There was no history of loss of weight. Appendectomy had been performed eight years before.

Preoperative treatment was given. April 25, choledochostomy was performed. The Mayo-Robson hepaticus drain was used. The gall-bladder was definitely inflamed, but contained no stones. The common duct was dilated and when opened, watery, colorless bile, and considerable mucus gushed from it. A stone which was wedged at the ampulla was removed without difficulty. Biliary cirrhosis was present. Convalescence was uneventful. 270 c.c. of bile drained during the first twenty-four hours; 360 c.c. during the next twenty-four hours; and 450 c.c. during the next twenty-four hours. The tube came out on the seventh day. There was no drainage of bile after the eighth day.

Comment. It was difficult to make a diagnosis in this case in spite of the fact that there was eventually a complete obstruction of the common duct. In several instances when the chief complaint was gastric, we were unable to determine that the patient had enough trouble to warrant an operation for gall-bladder disease.

Case XVII (A376062).—Mrs. F. W., aged forty-eight years, was examined April 20, 1922. She had had gall stone colic for twenty years.

August 3, 1921, cholecystectomy and choledochotomy were performed. The common duct was found to be distended and filled with stones. October 16, 1921, the patient had a chill and fever followed by jaundice, which continued,

though the degree fluctuated. Since February the patient had had two attacks of colic. Loss of weight has been continuous (61 pounds in one year).

April 28, 1922, following preoperative treatment choledochostomy was performed. Hepatic cirrhosis 3 was present. The liver was large, firm, hard and granular, and oozed when it was touched. Many adhesions were noted. The common duct was large and dilated, and the distal part was apparently gone. No communication with the bowel could be located. On opening the common duct, about 180 to 240 c.c. of colorless fluid, with no suggestion of bile pigment, but containing considerable pus, escaped. It was believed that there was a stone in the common duct, but operation revealed none. A tube was placed in the duct. The patient did not improve. 60 c.c. of bile was drained in the first twenty-four hours, 60 c.c. in the next twenty-four hours, 90 c.c. in the next twenty-four hours, after which the drainage ceased. The patient gradually declined and died on the eighth day. The blood urea was 176 mg. on the seventh day; the urinary output was satisfactory throughout. Necropsy was refused.

Comment. The marked loss of weight in this case is characteristic of complete obstruction of the common duct. The case is also of interest because from the time of operation although the patient seemed to be getting on satisfactorily, there was no increase in bile drainage and death ensued, apparently from insufficiency of the liver and uremia.

Case XVIII (A277704).—Mrs. H., aged twenty-seven years, was examined April 20, 1922. She had had an appendectomy five years before. She complained of severe pain in the left upper abdomen, with belching, bloating and vomiting, requiring morphine for relief, and followed by residual soreness. The first attack occurred during pregnancy; two more attacks occured later. Slight jaundice accompanied each attack. October, 1921, cholecystectomy was performed

elsewhere, but no stones were found. Bile drained for two weeks. In January, 1922, the patient began to be jaundiced, and the jaundice gradually increased in severity. In March, 1922, she had an attack of sudden, severe pain in the left upper quadrant, with rigidity of the left upper rectus, requiring morphine, and followed by soreness in the upper quadrant. The patient had lost 13 pounds in three months.

May 10, 1922, choledochostomy was performed. Postoperative biliary cirrhosis was found. The liver was small. Adhesions to the hepatic duct were separated, and the hepatic duct opened. Watery fluid, without bile pigment, gushed from the duct. A small opening was made in the hepatic duct, a rubber catheter was inserted and its end closed, thus producing a condition very similar to that existing before operation. The pressure was gradually released in an effort to stimulate the liver function. Four postoperative blood transfusions, 300 to 500 c.c. each, were given. Chills occurred for several months. September 27, another operation was performed to reconstruct the common duct. A T-tube was inserted. 300 c.c., 380 c.c. and 380 c.c. of bile drained in three successive twenty-four hour periods following operation. The patient left the hospital on the thirteenth day and was dismissed from the Clinic, October 13, carrying a T-tube.

Comment. At the time of the reconstruction of the common duct the jaundice had almost completely subsided. This patient is now wearing a T-tube, which will be removed in a few months.

Case XIX (A396281).—Mr. N. C., aged sixty-seven years, was examined June 29, 1922. He had had no previous diseases, except influenza in 1889. Three years before, cholecystectomy was performed elsewhere. He came to the Clinic because of jaundice, pruritus and loss of weight. In September, 1918, he had an attack of pain in the upper abdomen, requiring a hypodermic; this attack was followed

by soreness for several days. Three months later he became jaundiced and began to lose weight. His stools were white and he had no appetite. No stones were present at the time of the cholecystectomy in May, 1919. The jaundice cleared up in one month, and he began to gain weight and to feel well. In September, 1921, he again developed jaundice and lost 40 pounds in weight; the jaundice persisted. For one month prior to examination he had continuous dull pain in the epigastrium.

At examination the patient was markedly jaundiced and bile 3 was found in the urine, and the stools were gray. July 24, 1922, choledochostomy was performed. Carcinoma of the ampulla was revealed, and the common duct was extremely dilated. The large and small intestines were very tense. Mucus-tinged, clear, colorless bile was found in the common duct. There was a movable, free growth in the ampulla.

Comment. The extreme dilatation of the common duct resulted from an obstructing neoplasm at the ampulla. We were able to put a small catheter into the common duct without releasing the pressure, and gradually to produce decompression. The fluid from the duct was at first colorless, but in six hours it became bile-stained. This patient is comfortable at present with the tube in his common duct. As he is sixty-seven years of age, there is some question as to the advisability of submitting him to operation for resection of carcinoma of the ampulla.

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PAPILLOMA AND ADENOMA OF GALL-BLADDER

By Irvin Abell, M.D.
Louisville, Ky.

Benign neoplasms of the gall-bladder have been regarded as of rare occurrence, the vast majority of tumors which have been observed in this organ and reported being of malignant type. A search of the literature reveals a paucity of articles dealing with or descriptive of benign tumors of the gall-bladder. Sutherland[1] in 1898 reported an adenomyoma; Ringel[2] in 1899 a papilloma; Stanmore Bishop[3] in 1901 described an unusual, innocent growth the size of a child's head, most probably a papilloadenoma; A. W. Mayo-Robson[4] in 1905 an adenoma; Mayer[5] in 1911 reported the transformation of the gall-bladder into a papilliferous tumor; M. Dominici[6] in 1911 reported a diffuse papilloma involving the entire mucous membrane of the gall-bladder and gave a résumé of the literature up to that date. In 1911 Sand[7] and Mayer collected 8 cases of papilloma. Irwin[8] and McCarty in 1914 reported the finding of one or more papillomas in 85 of 2168 gall-bladders, and in 1915 C. H. Mayo[9] reported 107 cases of papillomatous disease in 2538 cholecystectomies. The recent text-books and monographs on disease of the biliary tract either do not mention the incidence of such tumors in the gall-bladder or else dismiss the subject with the statement that they are of rare occurrence, while the description of benign tumors of the gall-bladder occupies but small space in the works on pathological anatomy.

Papillomas, especially of the villous type, occur on the mucosæ with comparative frequency, particularly in the gastrointestinal tract, and are usually found in the course of chronic irritation, either mechanical, chemical or infective. The gall-bladder, being a common site for chronic infective disease, shows not infrequently the presence of such tumors when routinely subjected to microscopical study.

The adenomas are usually regarded as the best example of Cohnheim's theory of tumor genesis and the fetal types are readily explained by this hypothesis. So far, adenoma of the fetal type has not been observed in the gall-bladder, while the adult type has been described by several observers.

The facts that only in exceptionally rare instances have the tumors given rise to symptoms *per se*, the clinical aspect being that of chronic cholecystitis and the microscopical picture that of chronic cholecystitis plus the presence of unsuspected tumor, would seem to indicate rather conclusively that the neoplastic development was secondary to the irritation of a chronic infection. Both tumors, papilloma and adenoma, occur with and without the presence of stones, and ordinarily there is no correlation between the presence of the tumor and the clinical symptoms.

In 288 cholecystectomies done between July 31, 1915, and October 1, 1922, and subjected to routine microscopical examination, 8 presented benign tumors (5 adenomas and 3 papillary adenomas). In the 5 adenomas the tumor was single and small, in 2 of the papillary adenomas a large portion of the mucosa showed multiple papillary outgrowths, while in the remaining papillary adenoma the mass filled the gall-bladder. In 7 of the cases gallstones were present, there being none in the case presenting the largest tumor growth. In 7 in which the gall-bladder wall was sectioned and examined chronic cholecystitis was present. The youngest patient was aged thirty-one years, the oldest sixty three years; average age, 48.3 years. All the patients were females—this doubtless is to be explained by the

greater frequency of gall-bladder disease among women than among men. 7 of the 8, including the case in which no stone was present, gave a history of colics, and all had suffered for years, from four to twenty, with digestive disturbance.

The clinical picture presented in all of the cases was that of cholecystitis and cholelithiasis, and the findings at operation revealed that the symptoms in seven were correctly ascribed to cholecystitis with calculi, while in the eighth the tumor was largely responsible for the appearance of symptoms.

The case is of sufficient interest and rarity to merit a detailed report. The patient, female, white, aged fifty-eight years, came under observation first in August, 1919. Her father had died at the age of seventy-four years, with cancer of the pancreas; the family history was otherwise negative. Her only severe illness up to the inception of the present had been typhoid fever at thirty-eight years. She was married, had had no children and had passed the menopause at forty-seven years. Her present trouble began in 1915, with an attack of pain under the right costal margin accompanied by chill and fever. She had similar attacks in 1916, 1917 and 1918. During these years, and for many preceding the onset of colic, she had digestive disturbance, characterized by fulness after eating, gaseous distention and abdominal discomfort. Six weeks before coming to the infirmary she had a severe attack of colic, requiring opiates for relief, followed by chill, fever and jaundice, the illness confining her to bed during this period of time.

Physical examination showed the skin and mucosæ pale with a distinct icterus present. Temperature normal; pulse 84; cardiac dulness one-half inch outside the nipple line, with sounds distinct and regular; no murmurs present. Blood pressure, 158/92. Lungs negative. Abdomen showed marked tenderness and rigidity under the right costal margin extending downward to the umbilicus. Pelvis negative. Urine, negative. Blood: Hemoglobin, 80 per

cent; red blood cells, 4,080,000; white blood cells, 12,200, polynuclear neutrophiles, 68; small lymphocytes, 25; large lymphocytes, 6; eosinophiles, 0.5. Diagnosis: Acute cholecystitis.

At operation, September 2, 1919, the gall-bladder was found covered by the stomach and intestinal and omental adhesions; upon separating these the wall and mesentery of the colon were found thickened and indurated, as was the liver tissue adjacent to the gall-bladder; the latter was thick-walled, rigid and apparently distended; upon introduction of the trocar no fluid was obtained. Upon incising the gall-bladder it was found filled with a soft, friable, epithelial mass, sessile in character and apparently involving the greater portion of its mucosa. A large amount of this was removed with the curette, bile appearing when the cystic duct was reached; no stones present. The whole picture appeared to me to be typical of a villous carcinoma, and the induration in the liver, wall and mesentery of the colon was interpreted as extension by contiguity and as rendering the case unsuitable for cholecystectomy. My conviction as to malignancy was so firm that none of the specimen was preserved for microscopical analysis. The gall-bladder was drained, the indurated area on the colon and the adjacent gall-bladder wall isolated by a cigarette pack and the abdomen closed. The patient was discharged from the hospital nineteen days later and sent home with the diagnosis of advanced carcinoma of the gall-bladder.

I heard nothing further from her until in November, 1920, thirteen months later, when another patient from the same community, to my great surprise, told me that she had lost her jaundice, had gained in weight and strength and regarded herself as well. I saw the patient again, July 8, 1922, and obtained the following history: After returning home in September, 1919, she continued weak and ill for four months, during most of which time she was in bed. The jaundice disappeared and drainage wound healed. Begin-

ning with January, 1920, she rapidly regained her health and strength, and continued well until February, 1922, when she had an attack of colic, followed by chill, fever and jaundice, being confined to bed for two weeks, all symptoms disappearing by the end of the fourth week. She then remained free of symptoms until May 28, when she had another colic, followed by chill, fever and jaundice, and had been confined to bed until coming to the infirmary, July 8. Her weight was greater than at the time of the operation in 1919; pulse rate and temperature normal; heart and lungs negative. Distinct jaundice was present. Right upper rectus scar in good condition: Slight tenderness on deep pressure under right costal arch; slight rigidity; no palpable mass. Blood showed hemoglobin, 85 per cent; red blood cells, 4,770,000; white blood cells, 10,500; polynuclear neutrophiles, 64.5; small lymphocytes, 31.5; large lymphocytes, 4. Urine showed a trace of albumin, much bile, an occasional hyaline cast, four to ten blood cells and three to five leukocytes to one-sixth field of the microscope.

Judging from her history subsequent to the operation in 1919 and her improved general physical condition, it was evident that the conclusion as to the presence of malignancy was erroneous. It was now believed that the tumor observed in 1919 was a villous papilloma, but we were at a loss to explain the origin of the two subsequent attacks of colic. Were they due to extension of the tumor, to adhesions or to common duct stone?

She was operated on July 12, 1922, with a diagnosis of common duct obstruction. The scar of former operation was removed and the abdomen opened, finding the stomach, duodenum and colon adhered to the under surface of the liver, and with the latter to the abdominal wall. Upon separating these the gall-bladder was found to have disappeared, there being no visible vestige of it or the cystic duct. The common duct was enormously distended. No stones could be felt and the introduction of an aspirating

needle into the duct failed to show the presence of fluid. The common duct was incised over the point of greatest enlargement and a mass of what appeared to be epithelial overgrowth, pale gray and cheesy in appearance, presented in the incision. The incision was extended and a large amount of this material removed, finding it to fill the common duct from the junction of the hepatics to the papilla of Vater. The growth sprang from the ductal mucosa at a point corresponding to the usual site of junction with the cystic duct, involving an area approximately one and a half inches long and three-fourths of an inch wide. The attached portion of the growth was removed with the curette and scissors and the base cauterized with the actual cautery. The distention of the common duct was such that the finger could be easily introduced into each hepatic duct, and the tip of the finger readily entered the duodenum at the papilla of Vater. The duct was drained with a T-tube, the incision in it sutured with catgut and the abdomen closed, bringing the drain out of a stab wound to the right of the abdominal incision. The jaundice disappeared, recovery was uneventful and the patient was discharged from the hospital well on the twenty-third day. Microscopical diagnosis of tumor was papillary adenoma, non-malignant.

The case presents certain interesting points: The size of the growth in the gall-bladder, its rarity and the close resemblance of its gross appearance to that of villous carcinoma, a frequent type of malignancy in this situation, is a prominent one. The presence of digestive disturbance years before the appearance of the first colic would argue for the existence of a chronic cholecystitis antecedent to the development of the tumor; certainly the presence of inflammatory infiltration at the time of the first operation complicated the picture and contributed to the difficulty of correctly interpreting it.

Another point of interest is the complete disappearance of the gall-bladder and cystic duct, although at the first

operation nothing further was done than a curettement of the villous mass. Again, the size of the growth in the common duct, the enormous distention of the latter, with the typical clinical syndrome of common duct obstruction, most usually due to stone.

Finally, was the growth present in the common duct at the first operation, or did it extend along the mucosa by contiguity coincident with the obliteration of the gall-bladder and the cystic duct, or did it result from contact implantation, as is so often noted in papillomata of the urinary bladder?

Conclusions. 1. Benign tumors of the gall-bladder, notably papilloma and adenoma, are not so rare as formerly thought, occurring in the Mayo series once in every 23½ cases of cholecystectomy and once in every 36 cases of the series herewith reported.

2. The invariable presence of chronic inflammatory changes in gall-bladders containing such tumors would argue the importance of chronic irritation as an etiological factor in their development.

3. The overshadowing clinical picture is that of cholecystitis, there being no correlation of symptoms with the presence of such tumors.

4. The fact that such tumors occur in the course of chronic cholecystitis is an additional argument in favor of cholecystectomy.

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SURGERY OF THE ACUTE GALL-BLADDER

By Robert Caldwell, M.D.
Nashville, Tenn.

The acute gall-bladder is the source of extreme hazard for the patient and attended with such grave responsibility to the surgeon as to make it the most serious acute surgical affection of the upper abdomen. A somewhat limited review of recent gall-bladder literature showed a marked absence of discussions upon the acute gall-bladder. Having recently been impressed by the frequency with which we encounter the condition, together with an absence of crystallized surgical opinion, I feel that I have sufficient excuse for bringing the subject briefly to your attention at this time.

Under the term of acute gall-bladder we shall include all types of the fulminating gall-bladder, whether it be the gangrenous, the acute empyema, the perforated or the thickened infiltrated wall, which is accompanied by marked reaction. The reaction is manifested by high temperature, general prostration and frequently markedly increased leukocytosis, together with all the physical phenomena of an "acute abdomen."

The first of the two problems that I would have you discuss is whether we shall treat these cases in a medical way, endeavoring to get them to a subsidence of the acute symptoms before resorting to surgery, or shall they be subjected in the very beginning? I am fully aware that if we could always know just the type of process that is developing in the very onset, it would be a very simple matter to

arrive at a definite conclusion as to the procedure to be adopted.

Probably no one advocates delay in the gangrenous or perforated gall-bladder, but who can tell in the very beginning which case is going to develop into a gangrenous or perforated gall-bladder; or whether it is going to subside readily, as they most often do; or whether it will, as they frequently do, develop a marked cholecystitis, with very much thickened gall-bladder walls, accompanied by more or less extensive pericholecystitis?

Within the past month a case came under my care that had no rise of temperature and only 10,800 leukocytes fifteen hours after onset, with a temperature of only 100° and no increase of leukocytes thirty hours after onset. The pain was extreme at the beginning, and after thirty hours she had the physical signs of an "acute abdomen." About forty-eight hours after onset this patient was operated. The peritoneal cavity contained 1000 cc or more of bile-stained fluid. There was no macroscopical perforation of the distended gall-bladder that did not contain stones. However, on the under surface of the gall-bladder there was an area the size of a silver dollar which was very much bile-stained and looked as if the bile had been strained through at this point. The gall-bladder was removed and the patient left the hospital within two weeks. This patient recovered, but she would unquestionably have taken less risk had she been operated on at admission. She would as certainly have lost her life had we persisted in the expectant plan of treatment.

Many advocate the treating of these cases on the expectant plan until such time when the symptoms would indicate that the pathological process has progressed to the stage of hopelessness so far as medical measures are concerned. One author makes the general rule that if after forty-eight hours from the beginning of medical treatment no improvement is manifested, operation should be resorted to.

Another says, if progress is not controlled by ice-bags,

operation should be resorted to in cases with peritoneal symptoms, since the exclusion of appendicitis may be impossible. The argument advanced most frequently in opposition to early operation in acute gall-bladder cases is that they so infrequently progress to the stage of gangrene, perforation, empyema or a marked inflammatory process in the walls with pericholecystitis.

I am going to venture the assertion that the percentage of these acute processes in the gall-bladder is almost as great as perforation and gangrene of the appendix. We have not been impressed by them as in the appendix, for the whole number of appendix cases is so much in excess of the gall-bladder cases. I feel that we are stating the case conservatively when we estimate that not more than 15 per cent of the acute appendix cases will progress to the stage of gangrene, perforation, abscess formation and death if allowed to go without operation. This same percentage has prevailed with the gall-bladder cases coming under my observation in the last three years, and I feel quite sure that an equal percentage of acute cases were observed prior to this time. It is not denied that the cases which do not progress to the stage of gangrene or perforation will reach a receding stage when they *may* be as safe a surgical risk as in the beginning; but I believe it can be denied that they are *more* safe, because unquestionably these are the cases in which extensive adhesions will be encountered. While waiting for this recession they have been subjected to the risk of perforation and gangrene together with a wider dissemination of the infection to the liver and pancreas. The latter is recognized as a real danger, especially since Graham has recently called to our attention the relationship of the gall-bladder and liver and the gall-bladder and pancreas through the lymphatics. Many leaders of the profession have frequently referred to the dissemination of infection to the pancreas by way of the lymphatics. I am inclined to believe that we will soon come to realize that pancreatitis is a blood-stream, lymphatic-

borne infection rather than a regurgitation of bile into the pancreatic ducts, just as we have done with infections of the gall-bladder. The mortality will certainly be increased in the cases that have gone through one or more of these acute processes, on account of extensive adhesions and residual foci of infection, above that of ordinary chronic cholecystitis. Add to this increased mortality the very high mortality that exists with the delayed perforated or gangrenous cases, and I cannot help but believe that it will be several points higher than if we operate upon these cases early in the onset of the infection.

While we all recognize the increased danger of any operation in the presence of an active infection, yet if we get these cases before the infection has had time to extend beyond the walls of the gall-bladder, and before the formation of adhesions and the prostration of the patient incident to the infection, I cannot see why our mortality should be but slightly, if at all, increased above that of the chronic cases. For these very obvious reasons it seems to me that early operation should be advised; in fact, that we should operate just as soon as a working diagnosis can be made.

Granting that we are now willing to accept the above conclusion that surgery should be employed at the earliest possible moment in acute cholecystitis, the real problem that next confronts us is, Shall we do a cholecystectomy or a cholecystostomy primarily, with the intention of doing a cholecystectomy after the subsidence of the active process? With a gangrenous or perforated gall-bladder there is no division of opinions, but all advise cholecystectomy unless the patient be *in extremis* or too dense adhesions make the operative procedure of cholecystectomy impossible. The case about which there is so much discussion is the large, thick-walled gall-bladder, the wall being as much as 1 to $1\frac{1}{2}$ cm. in thickness, filled with stones and pus or purulent and infectious fluid. The following are some of the conflicting opinions of both European and American surgeons. One

states very emphatically that he hopes cholecystostomy will be completely displaced by cholecystectomy in acute cholecystitis, and further contends that primary drainage followed later by excision of the gall-bladder is more dangerous than primary extirpation. Another is of very much the same opinion, but modifies it slightly by advocating, in a few instances where there is cholecystitis and pericholecystitis, with a gangrenous gall-bladder wall and considerable involvement of the surrounding structures, that cholecystostomy with a pack drain is the best procedure. Another, in cases of acute cholecystitis, advises early operation and says the removal of the gall-bladder should be the operation chosen in all but a few exceptional cases. Another, in his early practice, advised waiting until the acute symptoms subside before operating, except in severe and threatening cases. Since 1916, he has been an advocate of early operation and advises cholecystectomy as a procedure of choice except in rare instances.

Another says that, "surgeons who have had sufficient experience in surgery of the gall-bladder and biliary ducts to realize these facts are convinced that cholecystectomy is the indicated operation in all infections of the gall-bladder with or without stones, and particularly indicated when pancreatitis is an associated lesion. Exceptions to this procedure are few and practically confined to the fulminating processes with local peritonitis, in which quick and efficient drainage gives the patient the surest and safest prospect of relief."

In 1908, Redell reported the statistics of thirty-two cholecystectomies done at the onset of the attack and showed this interference in a most favorable light. Finally, another is an advocate of cholecystectomy, but thinks that if it is to be done that it should be done before the infectious process has extended beyond the limits of the gall-bladder walls and before the patient is prostrated from infection.

One takes the opposing view in regard to the early opera-

tion, and, also, against primary extirpation. He claims that half his cases are sterile, and where there is infection, drainage is the most rational procedure. Another states that he had rather do two or three drainages in succession than one extirpation. Andreas Vischer, in a review of the cases of acute cholecystitis in the Basel Surgical Clinic from 1905 to 1918, arrives at the conclusion that we should do cholecystectomy only when the gall-bladder is perforated or threatens perforation; in other cases drainage. He advises conservatism in cases that show early improvement, on the ground that some never have a recurrence while in others with some improvement and a gain of strength they are better surgical risks. He also points out that in cases in which the symptoms subside and then reappear, in a few days drainage or extirpation should be done.

The great majority if not all of the above opinions are based upon a study of the acute gall-bladder after it has become a late case anywhere, from three or four to ten days or more after the onset. Why we have not come to advise these patients in the same manner that we do the appendix case I am unable to say. A great many writers refer to the close analogy of the gall-bladder and appendix, especially so far as the continuance of the infection is concerned. Dr. W. J. Mayo expresses this very tersely when he says, "The whole question, therefore, may be aptly compared with appendicitis. But we seem not to have continued the analogy to the treatment. We have all come to the idea of cholecystectomy in chronic cases and, since this is true, I feel that it should be extended to the acute cases. The custom of cholecystostomy in caute cholecystitis is a 'hang over' from our teaching when cholecystostomy was the procedure of choice in the chronic cases."

If we could get the cases of acute cholecystitis early, then a cholecystectomy could practically always be done, and I feel confident with no greater increase of mortality over the chronic case than the increased mortality of the acute appen-

dix over the interval appendix. It should be our duty to teach the medical man that it is just as essential to bring the acute gall-bladder in the middle of the night as the acute appendix.

I dare say we are all doing more cholecystectomies every year, though we are not getting them any earlier; in other words, there are fewer cases in which a cholecystectomy cannot be done. For three years now I have done a cholecystectomy on every acute gall-bladder, and they have been done on cases anywhere from one day to two weeks after onset. Several of them I have been content with setting a clamp on the duct and bloodvessels and allowing it to remain for from forty-eight to seventy-two hours. Half of these cases did not have bile drainage after removal of the clamp. A number of these cases in which the cystic duct is involved will have bile drainage even though the duct is ligated.

Conclusion: 1. Every case of acute cholecystitis should be treated surgically just as acute appendicitis.

2. Operation should be done as early as possible after the onset.

3. The plan of treatment should be cholecystectomy when at all possible.

4. The severe cases should be done the quickest way and with the least manipulation. The leaving a clamp on the cystic duct and vessel will fill this requirement.

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DISCUSSION ON THE PAPERS OF DRS. SHERRILL JUDD, ABELL AND CALDWELL

Dr. Francis G. Du Bose, Selma, Ala.—It has been repeatedly said that this organization puts the stamp of finality on surgical procedures. The contributions of the essayists are most timely, particularly those of Dr. Judd and Dr. Caldwell, because they deal with extensive surgical procedures. I am glad to say that the impression that I have gained from these papers today as to the immediate operative results is a favorable one. I dare say that it will be ten years or more before there is a standardization of surgical procedures in gall-bladder disease. Today, with all of the great work that has come from the Mayo and other outstanding clinics, we are not convinced that the dictum laid down by Dr. Caldwell is final with reference to cholecystectomy. The only way that we can judge of these cases is by the system of follow-up and see what we have accomplished ten or fifteen years from now.

My observation of the end-results of several hundred cases of my own and many of other surgeons is that gall-bladder surgery even in the hands of the masters in this field is the least satisfactory of all surgery done on the body except surgery on the brain. Many of these patients are not cured. The home doctor, who has an opportunity to observe, knows that they are not cured; they are not even relieved of their symptoms in many instances at all. They go to the internist for treatment of digestive disturbances, and are being referred to different surgeons for repeated operations. The removal of the gall-bladder indiscriminately, or as the operation of choice, is a procedure which will at some future time prevent the utilization of the gall-bladder itself as a means of draining bile into the duodenum as a substitute for the common duct. This is especially true in cases of recurrent pancreatitis consequent to cholelithiasis. Such cases, in my opinion, have been permanently relieved for a period up to ten years by doing a cholecystenterostomy.

It is urged that a more extensive study of papers and contributions on this subject be done for the purpose of standardizing the teaching concerning gall-bladder surgery. After all, we must rely finally on the judgment of the individual surgeon as to when the gall-bladder should be removed, when

it should be drained and when it should be anastomosed either with the duodenum or stomach. A conclusion as to its functions, and how these functions ultimately may be conserved, should be made. My own views need clarifying. I am not ready to accept finality with reference to any fixed routine in gall-bladder surgery.

Dr. Eugene H. Pool, New York City.—I would like to mention a case which bears on Dr. Judd's paper. Eighteen months ago a patient, aged sixty-five years, came under my observation. About eight days before admission to the hospital he developed pain in the epigastrium, followed by intense jaundice. Operation was done and the gall-bladder was found much enlarged, and there was a number of stones. Around the common duct were inflammatory hyperplastic lymph nodes. The common duct was opened, but there was no bile in it. An instrument introduced down into the lower part of the duct removed two large stones. The stone searcher was passed upward into the hepatic duct and one stone was found and removed. There was no indication of bile. Naturally we were very much worried, as we could not explain this feature. The liver showed nothing abnormal except a chocolate color. Thinking possibly the explanation might be found in the liver itself, I removed a small piece for microscopic examination. A tube was introduced into the common duct.

About six or eight hours after operation a very small amount of clear, thin fluid exuded from the tube. This was followed later by very slightly yellow-tinged fluid. The color became deeper until about twelve hours after the operation it was a canary color. About 300 cc of fluid passed during the first twenty-four hours.

A pathologic report on the piece of liver removed showed marked infiltration around the bile capillaries, suggesting that some obstruction to them had taken place. Whether a transfusion of 900 cc which was made the preceding day contributed to the suppression of bile is problematic. Microscopic examination of the liver tissue showed it to be the seat of portal fibrosis, infiltrated with round cells. This infiltration was around the bile ducts and tended to compress them. The liver cells were stained with bile and the capillaries filled with bile. The explanation in this case was assumed to be a complete absence of excretion rather than absence of secretion of

bile. The patient did reasonably well for a few days, when he developed practically complete suppression of urine, and died of uremia.

Dr. William A. Downes, New York City.—I think the use of clamps in gall-bladder surgery is to be regretted. During the past year I operated on two cases of complete obstruction of the common duct, in both of which, as a routine, clamps were left at the time of the operation, and these cases required tubes to restore function. I think in one of them there was a permanent injury. If care is used in controlling hemorrhage and in isolating the ducts at the time, I do not think it is necessary to use clamps.

Dr. E. Denegre Martin, New Orleans, La.—In listening to these papers I have noticed that there are always two schools, one favoring drainage of the gall-bladder and the other favoring removal. I want to suggest a compromise method in these cases which has served me well where cholecystectomy in the hands of an expert would do very well, and probably the patient would survive the operation and drainage would mean a second operation and perhaps a long convalescence. The first case I did this operation upon was five years ago. The patient was a woman, aged fifty-nine years, who came in with an old gall-bladder full of stones. It was an acute case grafted on chronic lesions. Her condition was such that I realized the removal of the gall-bladder in my hands would probably have meant death. I used drainage and she made an uneventful recovery.

In four other cases I did the same thing and all the patients are alive today. None of them suffered from shock. I had none of the complications in these cases that come from cholecystectomy. The drainage was such as to drain the entire fossa. Here is a means by which you can effect a permanent cure, and I believe a report of five cases is sufficient to warrant the operation another time. This is the procedure: Split the gall-bladder from fundus to apex, remove the contents, curette or scrub with gauze, apply iodine and insert a cigar drain the full length. Usually the duct is obliterated and no bile will flow for several days; drainage is beneficial in these cases. Result: Drainage first, obliterated gall-bladder eventually and no danger of the complications which so often arise from cholecystectomy in these infected cases.

Dr. John T. Moore, Houston, Texas.—I hesitate to enter into a discussion on this subject. At one of the first meetings of the Southern Surgical Association which I attended the leaders in surgery in this country and of this Association were trying to fight out this question of cholecystectomy *versus* drainage, and, it seems to me, we are in the same position today as we were then. This discussion *pro* and *con* has been going on rather vigorously, but we have lost sight of some of the basic principles of physiology and pathology in the study of these cases.

I remember when Dr. Finney and Dr. Mayo discussed this subject, and Dr. Mayo at that time said the mortality from cholecystectomy was lower than that of drainage, and the percentage of cures was greater than that of drainage.

We find in the study of cholecystectomy cases that Nature has attempted to build back a reservoir or gall-bladder. Quite a large sac has been observed, formed from the common duct or a part of the gall-bladder where any of it had been left. There is a difference between the appendix and gall-bladder. Where you have a pathologic appendix and remove it, that is the end of it. The function of the appendix has been lost apparently, but not so with the gall-bladder. There is a function of the gall-bladder, and physiologists will ultimately establish that question more definitely than has been done up to this time. The solution of this question will be based on the known physiology of the gall-bladder when it is more definitely decided. As time goes on we will see more definitely whether people are benefited by the removal of the gall-bladder. I think there can be no question as to the removal of certain types of gall-bladders, but the routine removal of the gall-bladder is just not quite sensible.

Dr. Walter C. G. Kirchner, St. Louis, Mo.—The title of Dr. Judd's paper, "White Bile in the Common Duct," is misleading. When he explained colorless bile it recalled an interesting experience I had which is perhaps more or less in line with his type of cases. It had to deal with what has been called dehydration. The patient, a woman, had all the classic symptoms of gall-stones. She was operated on for this condition. A cholecystostomy was performed and drainage established.

An interesting point in this case was that the secretion which came from the tube was grayish and then colorless. In addition

the amount was very excessive. Quarts of this fluid were obtained; at the same time the patient was getting into a precarious condition. She was just like a patient in shock, with sunken eyes and ashen color. She was given hypodermocysis and pulled through all right.

I have been trying to ascertain the etiology of this condition. It is the only time it has happened in my experience, but I have felt that perhaps the nervous system has something to do with this condition, and, even granting that obstruction is a cause, it may be simply a remote cause in which the nervous system is influenced in such a manner as to excite this peculiar condition. I believe that offers to me a more satisfactory explanation than some of the others.

Dr. William D. Haggard, Nashville, Tenn.—The question raised by Dr. Moore is an important one, but it is not a question of whether we shall drain the gall-bladder but a question of the time of interference. For my own part I think there is no doubt of the wisdom of removing the gall-bladder in the beginning, as stated by the essayist. The great trouble is that we do not see these cases on the first day. They are not so severe, as a rule, as the appendix case; as a consequence, we do not see them until the third, fourth or fifth day. The great majority of gall-bladder cases do survive and get over the acute attack. I think the difficulty lies in attempting to operate upon a patient after the disease is full blown, infection is quite frank and that is notoriously an inopportune time to operate. I think most of us have been confronted with this practical difficulty. A patient has an acute cholecystitis, comes into the hospital and wants to know how soon we will be ready for operation. We let a week or ten days go by and are finally inveigled into operating on the patient too early, whereas if we got these cases at the beginning there is no objection to removing the gall-bladder in the first few days, if there is no contraindication. On the contrary, if the case does not present itself until the condition is such as I have described in the delayed cases or those of the subacute type, let us wait until the patient gets over the attack. I think that has been the custom for a long time, and personally, when I am confronted with an acute gall-bladder in the very beginning, there is every reason why it should be removed and none why it should not be.

In regard, however, to the actual removal of the gall-bladder *versus* drainage in this group of cases, I would exclude the acutely inflamed and water-logged, thickened gall-bladder. It is difficult to isolate the cystic duct, and the whole tissues are swollen greatly. These cases do better if drained. Moreover, they ought not to be manipulated for stone, and all we want is quick drainage in those cases. I feel like agreeing with the essayists to the extent that in very acute cases, why wait?

Dr. Francis Reder, St. Louis, Mo.—The clinical significance of so-called white bile, which I regard as penned-up bile deprived of its coloring matter in a distended gall-bladder, has led me to invariably infer that there is an obstruction of the cystic duct.

The case I have in mind was operated on some eight or ten years ago. The patient received temporary benefit from the operation. Cicatrization went on satisfactorily and no fistulous tract remained. In the course of time this patient was again seized with pain characteristic of a gall-stone colic. In this case an operation revealed a stone impacted in the cystic duct. An impacted stone in the cystic duct sometimes presents great difficulty in its removal. The method of procedure described by Dr. Martin, *i. e.*, splitting of the gall-bladder down to the point of obstruction, removing the stone and introducing a drainage tube, is an admirable procedure and as safe as any one I know of.

With reference to cholecystectomy and the danger to the common duct, I can earnestly appreciate the factor of safety exercised in avoiding trauma to the common duct. I would rather have a fistula develop later from the cystic duct than have an injury inflicted upon the common duct.

I recall two recent cases where leakage had taken place from the severed cystic duct which showed itself as a tumor in the course of two weeks. The tumor was incised and good drainage established. These patients made good recoveries.

Dr. Charles G. Mixter, Boston, Mass.—I would like to suggest a possible analogy between the cases Dr. Judd referred to, of white bile in the common duct, and the congenital obliteration of the bile ducts which we see occasionally in the newborn. In these cases, frequently, along the course of the bile duct, we find a cyst containing clear fluid. The radicles

in the liver are bile-filled. The hepatic substance shows a more or less extensive cirrhosis. May we not have cases where there is temporary suppression of bile, quickly followed after operation by the appearance of yellow bile, in which there is a temporary cloudy swelling of the liver substance? Whereas in the other cases where bile does not appear after operation the back pressure has been so prolonged as to cause suppression of the hepatic secretory activity.

Dr. Judd (closing on his part).—The case of benign tumor of the common duct which Dr. Abell reports is unique. We have not seen one like it at the Mayo Clinic.

I agree with Dr. Caldwell that cholecystectomy is indicated in cases of acute cholecystitis with few exceptions. If the patient is almost moribund this operation is, of course, contraindicated. In cases of acute cholecystitis associated with acute pancreatitis, cholecystectomy is contraindicated and the gall-bladder should be drained. Dr. Pool's case is similar to the one which I reported.

I do not understand Dr. Kirchner's case and would like to know whether it was a drainage of the gall-bladder or the ducts.

Dr. Kirchner.—Drainage of the gall-bladder.

Dr. Judd.—That would be a secretion from the gall-bladder rather than from the common duct.

Dr. Abell (closing on his part).—Dr. Judd has given us a very instructive study of white bile. I have seen a few of these cases, two of which occurred in the presence of carcinoma of the papilla of Vater and the remainder in connection with common duct obstruction due to stone. My own interpretation was that it was due to obstruction plus a secondary infection, and that the pressure in the liver interfered with the secretion of bile. My own experience has been that such cases are attended with a much higher mortality than the ordinary obstructions in the common duct which we have observed.

In regard to the removal of the gall-bladder in acute cases, there are several facts we should remember: If we can assume that the gall-bladder represents the only pathology present, it will be much easier to agree upon the treatment; but this condition does not always obtain alone. In fact, so frequently

the opposite is found: Gall-bladder disease has been present for a long time and the gall-bladder represents but a small part of the pathology. We have an associated cholangitis, pancreatitis and hepatitis, and frequently, from the focus of infection, myocarditis or nephritis. Such cases present an acute exacerbation and a case of existing infection presents quite a different problem from one in which the gall-bladder is solely the site of the disease.

In my own experience, as we have seen more and more of these cases, our practice has been more and more toward the removal of the gall-bladder when we can reasonably assure ourselves it is the sole site of the disease, regardless of whether it be gangrenous or what not.

The technic Dr. Martin suggested of endeavoring to isolate the duct and separating the inflamed area by removing the mucosa and draining is very good, as you get a disappearance of the gall-bladder, just as in the case of papilloma which I reported, in which a second opening of the abdomen showed that the entire gall-bladder had disappeared. This is virtually what we have done by primary cholecystectomy. Disease of the entire biliary tract is of such importance that it becomes a grave condition and your pathologic ideal must be subordinated to the essential ideal of saving human life, and consequently your operation in many of these cases must be from a pathologic standpoint, an incomplete one.

We have gone back over 281 cholecystostomies and have subsequently removed the gall-bladder in 18 of our own cases. There are a number of those in the series operated on by other surgeons, and still others in the series which at the present time should have the gall-bladder removed. The pathologic ideal is the removal of the gall-bladder, but this must be subordinated to the greater indication of saving human life.

Dr. Caldwell (closing).—The burden of my paper was to educate, if we could, the profession to bring these acute gall-bladder cases to us as soon as they manifest symptoms of acute cholecystitis. A patient, for instance, this morning is seized with a sudden, severe pain and symptoms of acute gall-bladder; his temperature is 102°. As soon as a working diagnosis can be made of these cases of acute cholecystitis, let us get the general practitioner to bring them in and have the gall-bladders taken out.

As to Dr. Downes' objection to leaving clamps on, I do not see very much logic to it, for the reason that if you injure the duct placing a ligature, you will have the same unfortunate result as with the clamp. I have had 4 cases in which I have used clamps without any untoward results.

These cases recover like cases of acute appendicitis. Of course, there are exceptions. If a patient is *in extremis* you cannot do any surgery on him. We might do as Dr. Crile suggested, make a little nick in the abdomen, slip a tube in and run, or do something of that kind. If a patient has any vitality, or resistance at all, I see no reason, unless the operative difficulties are insurmountable, for not lifting out the whole mass of infection.

Dr. Abell referred to infection in the other tissues if the gall-bladder was the primary source of the infection. In the light of Graham's work and that of other men, we have a vicious circle, and the gall-bladder is the focus from which infection is being taken up. It seems to me all the more important why we should ablate that gall-bladder, because it is the feeder for pancreatitis, hepatitis and so on. There are exceptions, and we expect men of this class to use good judgment in operative procedures in these cases.

The important thing is to get the practitioner to bring these cases to us in the middle of the night, if necessary, as in cases of appendicitis. We can cure these cases and not run the risk of empyema, perforation, gangrene, etc. The danger of perforation or of death, plus the danger of later operation, is very much greater than cases operated on early when the infection begins.

KIELLAND'S OPERATION FOR PROLAPSUS UTERI

By H. J. Boldt, M.D.
New York

It is my purpose to describe a modification of an interposition operation which was devised by Dr. Chr. Kielland, of Christiania, Norway, and which has for its purpose the placing of the uterus, in its entire length, on the anterior vaginal wall in a straight line, parallel to the vaginal axis (Fig. 1 ii) and the narrowing of the vaginal caliber.

The vaginal portion of the cervix is pulled forward and upward, so that the posterior surface of the prolapsus presents itself to the operator. Beginning at the cervical opening by excising a wedge of the posterior lip with a base scarcely ½ cm. wide (Fig. 1 *b*), (of course, the size depending upon the diameter of the portio), and continuing with downward incisions 6 to 8 cm. in length, gradually diverging (Fig. 1, *A*). The flap between the incisions is separated from above downward (Fig. 1, *C*.) but not cut off, and is placed beneath the retractor (Fig. 2, *A*).

It may happen, during the separation of the flap, that the peritoneum of the cul-de-sac of Douglas is opened. If so, then it must again be closed by suture. The vaginal mucosa, beginning at the edge of the incision on either side of the portio vaginalis and cervix, should be separated from the underlying structure, starting with a pair of blunt-pointed scissors, curved on the flat, and continuing with the finger to such an extent that the finger may surround it half-way or even to a slightly farther extent (Fig. 2, *B*). The under-

mining must be done to within about $\frac{3}{4}$ cm. of the terminal of the portio vaginalis. At this part the scissors must be used, but one should be careful not to perforate the mucosa.

The undermining and the wedge-shaped excision are necessary for the subsequent inversion of the portio and the cervix.

The posterior wound surface is now united for a length of from 6 to 8 cm., starting at the posterior lip. This, however, applies to the mucosa only, for the underlying structures must not be included in the suture (Fig. 3). This suture, when tied, should be left long to use subsequently by pulling upon it for inversion.

Now the vaginal portion of the cervix is drawn downward and the anterior surface of the prolapse is operated upon. An oval flap is resected, beginning about $\frac{1}{2}$ cm. beneath the urethral orifice and terminating at the cervical opening. This, then, excises the larger part of the urethral redundancy. (Fig. 4).

A similar small wedge as was excised from the posterior lip is likewise excised from the anterior lip of the portio vaginalis; the size of this also depending upon the size of the portio vaginalis. In instances of broad, flat, mushroom-like vaginal portions, the excision must be larger; it must always be sufficient to make the portio somewhat conical for the purpose of inversion.

The width of the flap to be extirpated will depend upon the thickness of the tissue and the size of the existing cystocele. On either side of the prolapse there should remain about two fingers' width of the mucosa, if one wishes to retain a medium-sized vagina.

On the anterior surface the mucosa (after excision of the flap) should be separated about a finger's width (Fig. 5), and a little more toward the urethral terminus, because this part of the mucosa is destined to cover the anterior surface of the uterine body.

These edges are now grasped with two pairs of small mouth-toothed clamp-forceps, about $\frac{3}{5}$ cm. this side of the

upper wound terminus (Fig. 5), to enable one more readily to draw the mucosa in front of the uterine body when, later on, the wound is to be closed.

The bladder is now separated from the cervix, starting with the customary transverse incision, and pushed upward. The viscus should not be separated so far laterally as is usually done in the customary interposition operation, and the Luschka bladder pillars should not be injured.

When the vesicouterine plica has been opened and the bladder catheterized for control, the body of the uterus is brought forward through the opening (Fig. 6). The tubes are then ligated (I prefer to excise a part of each tube at the uterine cornu—H. J. B.) and the bladder peritoneum is attached to the posterior uterine surface about the corpocervical junction.

Kielland does not consider it essential to sew the peritoneum to the uterus, since this may cause a slipping back of the body into the peritoneal cavity, thus sometimes making somewhat tedious work, because of the necessity of bringing it forward again.

A small cigarette drain is placed down to the point of suture, between the bladder and the uterus, and brought out at the upper wound opening.

The anterior vaginal wound may now be united by two methods: (1) A continuous suture of the vaginal wound, including the corpus uteri and the cervix in the suture, beginning at the wound's upper angle. The first suture, which includes the corpus, should be placed on the anterior surface of the fundus, not higher up than the origin of the round ligaments; *not at the summit of the fundus* nor on the posterior surface. This method, of using only a single-line suture, is applicable only in instances of small prolapsus or in the case of senile uteri; (2) as a rule, in the case of larger prolapsus, it is more convenient to make the suture in two stages. One begins at the lip of the cervix and sews upward to above the corpo-cervical junction. Here this suture is

discontinued. The cervix is included in the suture. Now the cervix with the portio vaginalis may be inverted into the vagina (Fig. 7).

To accomplish this one finger presses upon the portio (Fig. 8), while simultaneously, the other hand pulls on the posterior vaginal flap, or on the knotted catgut suture left there when working on the posterior surface. When this has been done the distal half of the vagina has been formed. In the depth of this vagina one no longer feels a portio vaginalis; only the anterior lip and the cervical opening are palpable. The posterior lip has been obliterated to touch.

Now the corpus uteri, if it is still protruding between the vaginal wound edges, is pushed back to its future position beneath the bladder. The vaginal wound edges, with the aid of the small-toothed forceps that have previously been placed upon them, are brought forward in front of the corpus. Should it be seen that there is too much vaginal mucosa for a moderately taut covering of the corpus, so much of the tissue as may be necessary should be excised.

The uniting of the edges should begin above, from the upper wound-angle (where the gauze drain was placed) (Fig. 9), and continued downward to the first suture. The stitches, beginning with the first, also take in the uterine musculature at least every second stitch.

The operation is completed by doing a pelvic-floor plastic operation. Extirpation of a Hegar flap, by continuing the incision made for the posterior flap on the posterior vaginal wall (Fig. 1). The upper point of the triangular Hegar flap will lie at the catgut knot (Figs. 3 and 10). The external incision over the perineum *is not made transversely* but bends into a point toward the anus (Fig. 10). The edges of the vaginal wound are united by a continuous catgut suture.

The underlying (venous) tissue is not taken in by the sutures in the Kielland operation. Only from about the carunculæ myrtiformes to the perineum the stitches penetrate more deeply on the lateral wall into the tissue. Inter-

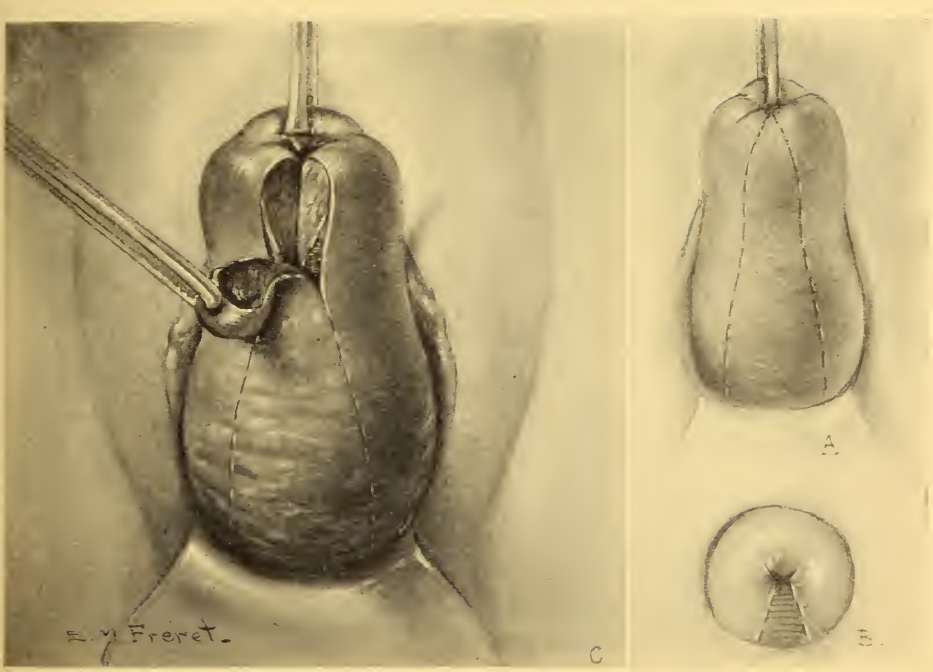

Fig. 1.—*A*, incision on posterior surface; *B*, exsection of cervical wedge; *C*, separation of the flap from above downward.

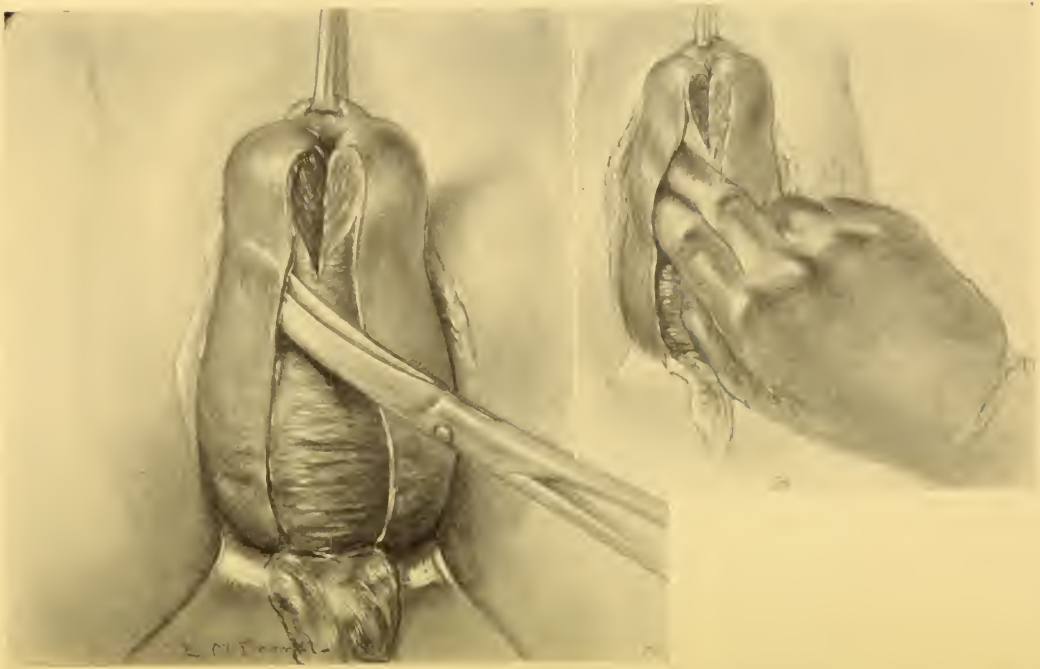

Fig. 2.—*A*, flap of mucosa dissected off. Flap not cut off but placed beneath retractor. Scissors detaching mucosa laterally. *B*, mucosa further detached with fingers.

Fig. 3.—Posterior mucosa united. The finger is introduced only to show that the cervical musculature is not included in the suture.

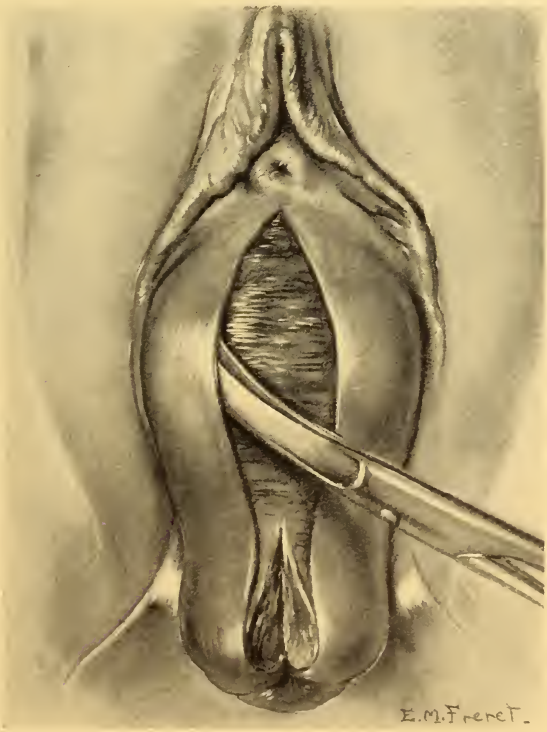

Fig. 4.—Anterior flap taken off.

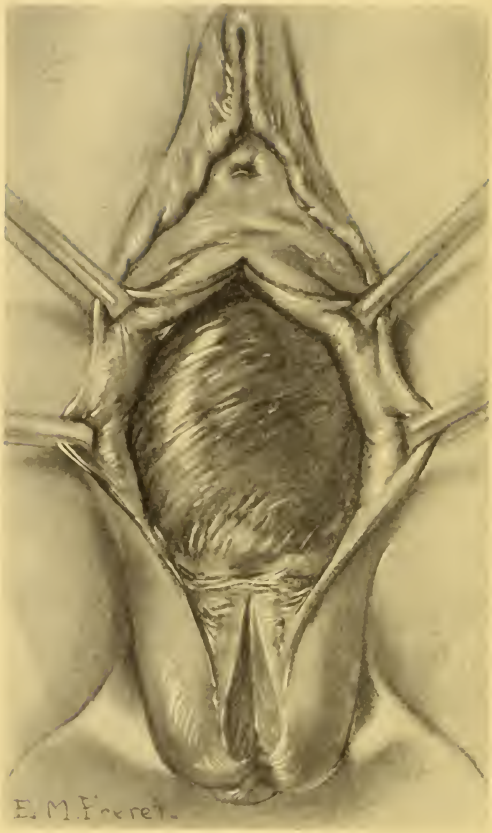

Fig. 5.—Mouse-toothed forceps grasping wound edges, making it possible to draw the mucosa more readily in front of the uterine body when the wound is to be closed.

Fig. 6 Fig. 7

Fig. 6.—The body of the uterus is brought forward through the opening.
Fig. 7.—The cervix and the portio vaginalis are inverted into the vagina.

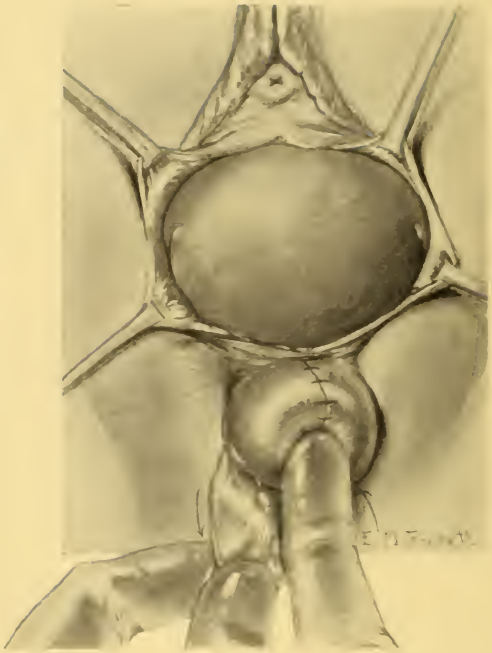

Fig. 8.—Method of inverting cervix and portio vaginalis into vagina.

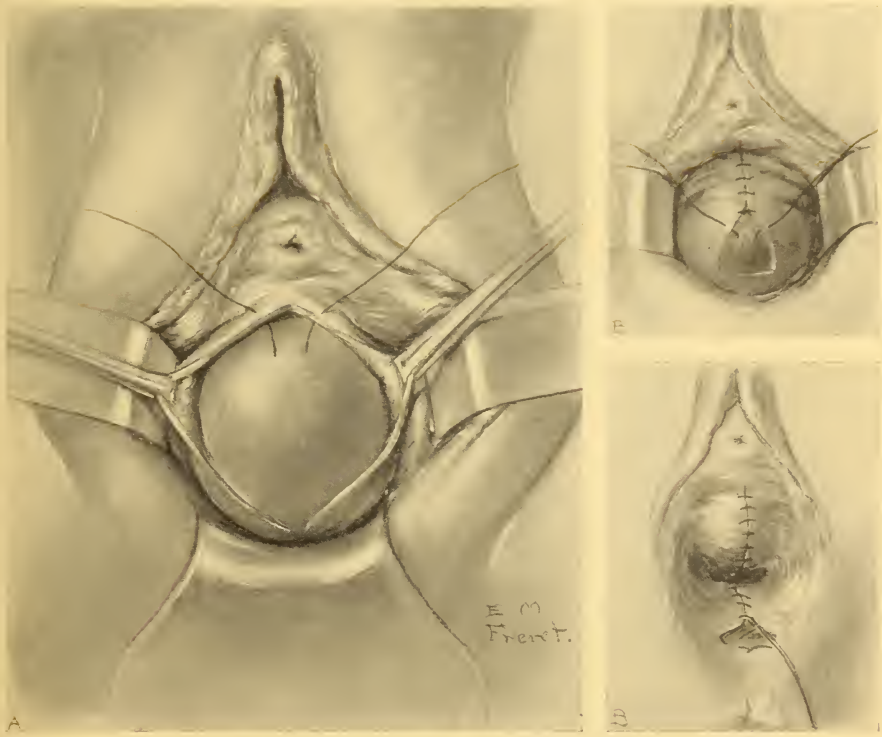

Fig. 9.—*A*, placing the first suture; *B*, continuing the suture.

Fig. 10

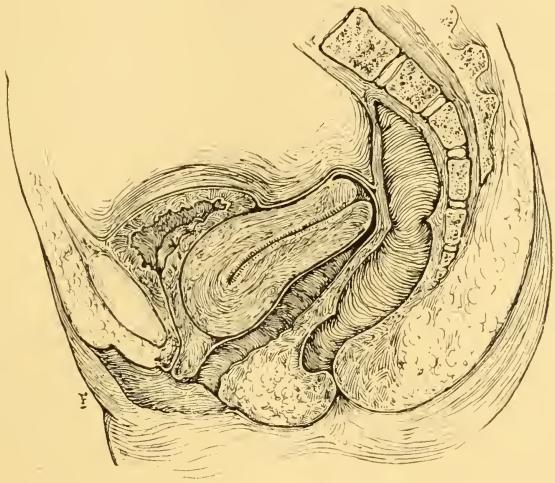

Fig. 11.—Position of the uterus after completion of the operation.

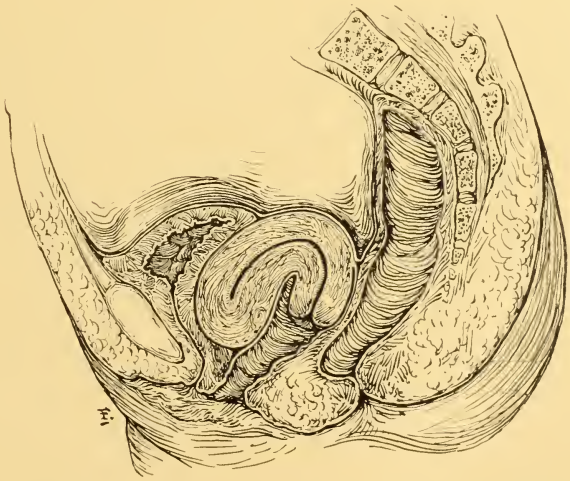

Fig. 12.—Position of uterus in original interposition operation, when vaginal part of cervix was not amputated.

rupted sutures are used for the pelvis floor. The levators are not sutured, except in cases of rectocele. The perineum is united with somewhat deeply placed silkworm stitches or those of fine catgut.

Kielland also places a small glass tube, 3 to 4 cm. in length, before placing the last suture, and fastens it with the last stitch. This is removed on the evening of the operation day. (For this I have not found a necessity.—H. J. B.).

The vagina is tamponed to the external orifice. A "T" binder is applied. The gauze-strip tampon is removed on the third or fourth day.

The operation, in a suitable instance, is not difficult from a technical point of view, since in cases of complete prolapsus the entire operation is done in front of the vulva. Only the suturing of the middle section of the anterior vaginal wall to the body of the uterus, and, possibly, the cervix and the upper part of the vaginoperineal plastic, are done in the interior.

One of the most important factors in all interposition operations is the judgment as to how much of the anterior vaginal wall must be excised. If the uterine body has been placed too far forward with the fundus against the vagina, or if the vagina has been separated too far laterally, it is possible to have a cystocele-like protrusion immediately following the operation. If, on the other hand, the technic has been correct, one should see a plane surface, or, still better, a slight retraction following the inward placement of the corpus uteri. When this cystocele-like bulging occurs it may be overcome by excising an oval-shaped flap from the vagina and a wedge-shaped excision from the uterine body; then closure of the wound.

Kielland asserts that in more than 150 such operations he has not seen one recurrence. The technic described has been used by him since 1911.

The modification of Kielland refers principally to the

treatment of the vaginal portion, which is not amputated but utilized as a prevention against a recurrence. The exclusion of a recurrence of this method of operating does not depend upon a lifting, suspension or fixation of the vaginal portion, since this may be loosened by subsequent intra-abdominal pressure. The exclusion of recurrence depends upon static reasons: The position of the uterus is straight and in parallel position with the axis of the vagina (Fig. 11). Intra-abdominal pressure acts on the posterior surface of the uterus and transversely to its long axis, and, therefore, presses the uterus against the posterior vaginal wall—and not out of the vaginal outlet (Fig. 11).

Because of the retention of the entire uterus the anterior vaginal wall has become more rigid, so that with the change of the vagina the organ cannot be pressed out.

Kielland claims that inasmuch as no levator suture is used (except in instances of rectocele), it is proved that levator suturing is not required in cases of prolapsus.

DISCUSSION

Dr. J. M. Maury, Memphis, Tenn.—This is an operation which is new to me and one which I do not feel able to discuss. I want to ask Dr. Boldt to explain if this posterior flap, the flap which he turns down first, has anything to do with lengthening the posterior wall of the vagina? If it has not the effect of doing that, I do not see how the operation raises the cervix any more than does the Watkins interposition operation.

Dr. Francis Reder, St. Louis, Mo.—I have followed Dr. Boldt as closely and carefully as I possibly could, yet I must admit I do not quite understand the technic. I gleaned the inference, however, that this operation must be a difficult one to perform, and that on account of its difficulty it may not become popular.

The other so-called interposition operations, such as the

Watkins, the Wertheim, etc., have given exceedingly satisfactory results in selected cases, when properly performed. Perhaps a closer study, when I have an opportunity of studying what Dr. Boldt has given us, will cause me to feel differently toward this operation. In my years of work, and I have done considerable vaginal work, I have had a strong inclination toward the more simple methods of operating in cases of prolapse.

Dr. Rufus B. Hall, Cincinnati, Ohio.—I want to thank Dr. Boldt for presenting this subject, and I will speak in reference to the interposition of the uterus in selected cases. There are cases of women approaching the menopause or after the menopause who have borne many children, with large procidentia, cystocele, rectocele, the uterus coming outside two or three inches or more, with no perineum excepting mucous membrane and sphincter ani muscle. Those cases are instances in which the operation of interposition is indicated, and it fulfils the purpose better than any operation I have found. These are the cases also in which I have seen many patients that have undergone hysterectomy, perineorrhaphy and narrowing up the vagina with the hope of curing them, but they did not remain well long. I have seen some of them made vastly worse afterward than they were before. Some of them have had large pelvic ventral hernias so that it was almost impossible to do any operation which would make them comfortable; whereas if you can save the uterus in these cases by interposition and amputate the cervix, if necessary, so as to make the uterus of the right length, I have yet to see a failure in overcoming the procidentia, the cystocele and rectocele. Of course, they are not as good as Nature made them before they had their babies, but they are well of the cystocele, the rectocele and procidentia, and they are comfortable. They are not comfortable, as a rule, where hysterectomy has been done to cure this condition. That is one of the conditions in which I think the operation of interposition gives the best results. Some of the worse results I have ever seen have been where the uterus has been removed to cure the condition.

Dr. Boldt (closing).—In regard to the question of Dr. Maury, I will say that the posterior flap is finally cut off, the vagina is narrowed and made more rigid by the operation.

So far as the difficulty of the operation is concerned, I will

say positively that of all interposition operations, this is the easiest of any I know, and I have done them all. The entire operation is done outside with the exception of a small part on the pelvic floor and on the anterior wall.

So far as the results are concerned, I must ask you to take Dr. Kielland's word for them. In the patients I have operated on the results have been very satisfactory. Dr. Kielland has done 150 of these operations, and he has assured me that in not a single instance has he had a recurrence.

CHRONIC ULCERATIVE COLITIS: ITS SURGICAL TREATMENT

By Harvey B. Stone, M.D.
Baltimore, Md.

(Read by Title)

The purpose of this paper is to call attention to a condition of serious character and by no means rare occurrence, and to a method of treatment that, while well-known, seems not to be utilized as widely as its merits warrant. Chronic ulcerative colitis is advisedly referred to as a condition rather than as a disease. Its etiology is not always clear and is not limited to a single agency. Any infection, amebic, pyogenic, tuberculous, luetic or from unidentified organisms may properly come under the descriptive name of chronic ulcerative colitis, and such cases are so included in this discussion. Other terms used in the literature with practicaly the same meaning are chronic dysentery and chronic suppurative colitis. It is, of course, desirable, if possible, to determine the type of infection. The use of the proctoscope, the microscopic and bacteriologic study of bowel contents, the Wassermann reaction, general physical examination and the history of the case are all utilized to discover the nature of the infection. By these means a certain number of cases may be clearly recognized as amebic, luetic or tuberculous. The therapeutic test of antiluetic treatment or emetin treatment may also be of value. But there remains a considerable group of patients who present ulceration of the large bowel, with colon and pyogenic

organisms present, and no more specific causal agent to be recognized. Certain cases, indeed, which begin as specific inflammations, as, for instance, amebic colitis, later acquire a secondary infection that so predominates as completely to obscure, if not actually to crowd out, the original infection. It is particularly this ill-defined but important group of cases, in which specific therapy is of little avail, that forms the principal object of consideration in this paper. However, any type of infection of the large bowel that is chronic and does not yield to the usual methods of treatment is equally subject to the descriptive remarks and the ideas of treatment herewith advanced.

Patients with chronic ulcerative colitis present a history of bowel trouble extending back for months and sometimes for a number of years. The onset may have been abrupt with acute dysentery, or gradual and insidious. Often there are periods of improvement, sometimes of apparent cure, followed by recurrence and another cycle of improvement.

The severe attacks are marked by numerous bowel movements—perhaps twenty or more a day—consisting largely of mucus, pus and blood. During these exacerbations there is loss of weight, abdominal pains, often severe, usually some fever and marked weakness. Eating becomes very difficult to these patients, not only because of complete loss of appetite, but even more because the entrance of anything into the stomach starts immediate reflex peristalsis in the colon with sharp pain and urgent desire to defecate. This particular symptom, as it happens, the writer does not recall ever seeing mentioned, but it has been an outstanding and troublesome feature of nearly every severe attack of chronic ulcerative colitis seen by him. Should the severe manifestations of the condition continue long the patient becomes gravely ill, and it is not impossible for a fatal result to ensue. Even though, because of treatment or a spontaneous recession in the infection, life itself is not lost, there is great loss

of weight and strength, and a condition of marked invalidism usually persists for weeks and months.

In the intervals between these fulminating periods, improvement slowly takes place, but usually with residual symptoms that show a persisting lesion in the bowel. There is a tendency to looseness and frequency of bowel movements, usually traces of blood and mucus in the stool, and with the proctoscope it may be seen that a hyperemia and granular appearance or even actual open ulcers are still present. Such patients, though better, are by no means well. Recurrence is very apt to take place. In fact, one of the striking clinical characteristics of chronic ulcerative colitis is its chronicity and recurrent nature.

Such is a fair picture of a condition that is fairly often met with and that means usually prolonged invalidism—involving perhaps years—and that holds a by no means remote threat of death. What is there to do for it?

The usual means of treatment are well known to all. For the specific types of infection, the specific remedies; emetin and quinine irrigations for amebic colitis; antiluetic treatment for syphilitis ulcerations; general hygienic care for the tuberculous. In addition, and particularly for the non-specific type of infections, various rectal irrigations, with solutions ranging from normal salt solution through the various antiseptics; bland and simple diet; rest in bed; opiates for tenesmus; bismuth by mouth; during acute exacerbations, fluid by hypodermoclysis and morphine freely. There are still other measures that various men resort to. It is not necessary to be exhaustive. Some cases perhaps get well, many get better for a while, a few die. Those, the majority, that only get better, sooner or later get worse again. Then the treatment or another like it is repeated. This sequence may go on for years. Is there anything better to do, and if so, when should it be done?

In 1895, Keetley suggested making use of the appendix as a semipermanent opening for irrigating the infected bowel

from above. Weir, in 1902, is credited with first performing appendicostomy. Since then this method of treatment for infections of the colon has been followed in English and Continental clinics, as well as in this country, and a considerable literature has grown up on the subject.[1 2] The results of appendicostomy, however, are not always satisfactory. It allows irrigation, but the colon is still irritated by the passage of feces, and a wider opening of the cecum—cecostomy—to allow not only irrigation of the colon but also to divert the fecal stream and put the colon at rest, was done by Boas, in 1903, for chronic ulcerative colitis. This has also its advocates.[3 4] But a cecostomy does not really divert entirely the contamination and irritation of the ulcerated bowel by fecal matter. To secure complete physiological rest of the colon, the logical method is to do a complete transverse ileostomy, as is well brought out by Payne[5], who credits Dr. John Young Brown, St. Louis, with priority in advocating this method.

What are the relative merits of these surgical methods? The writer has had some, though not extensive, experience with all of them. In general, after any of these operations, even in severly ill patients, there is immediate and rather dramatic improvement. It is not an isolated experience to note that a patient who has had fifteen to twenty painful, bloody stools daily will pass the two or three days after operation without any movement of the bowels whatever. This sudden cessation depends less on the type of operation than on the fact that, following invasion of the abdomen, there is a temporary paresis of peristalsis and remission of symptoms. It is in the subsequent course of events that differences may be noted between the several forms of operative treatment. Appendicostomy has the very considerable advantage that it avoids to a large extent the disagreeable features of an artificial anus. Soiling and odor are minimal or absent. *But it does not always cure colitis*, and recurrences and constant irrigation are drawbacks of great

moment to its success. The large bowel is not excluded and the treatment may fail of its primary purpose—the cure of the lesion. Cecostomy is no more certain in exclusion of the bowel, and has all the disadvantages of a fecal fistula in addition. Ileostomy is a more logical method, promises better results and in the experience of the writer, limited to a very few cases, has entirely succeeded. Such is also the experience of Payne. It has the serious drawback of an artificial anus, and women patients, particularly, are apt to refuse it. But the liquid normal contents of the small bowel soon change in character and much of the difficulty experienced in control of cleanliness in the early period after operation disappears. The stools become semisolid and regular and a certain control is developed. The writer has had three cases. Two are entirely well after two years and one year respectively, and the third has only recently been operated on and is still under treatment. Neither of the other methods of operating in a larger series of cases have done as well. It is the distinct impression that ileostomy is the method of choice.

In what cases should operation be employed? It is my feeling that any severe exacerbation of a chronic ulcerative colitis is in itself an indication for an operation that may save life. Further, any chronic case, even without alarming severity of symptoms, that has resisted the usual medical treatment for a number of months, should be operated on to terminate indefinite invalidism.

How long should surgical treatment be kept up? In other words, when can the artificial opening in the bowel be closed and the normal function of the large bowel be restored? The evidences of cure of the ulceration are as follows: A normal appearance of the mucosa on proctoscopic examination; the disappearance of all symptoms; the absence of pus or blood microscopically in centrifuged salt solution that has been run through the colon from the artificial opening to the anus. When these findings are maintained two months

after the stoppage of all irrigations, it is safe to close the stoma and reëstablish the alimentary tract.

It is incidentally of interest to note how well patients tolerate complete exclusion of the colon. Both the cases now cured began to gain weight and strength at once after ileostomy, even with the entire colon thrown completely out of function.

The detailed steps of operation in all of these procedures is well known. The only comment that the writer desires to make in this matter is in regard to the method of closing the ileum used in the last case done. The steps described by Halsted,[6] in his article on sterile blind end-to-end suture of the large bowel, were adapted to this purpose. The ileum is divided by the cautery between two purse-string sutures, and the two blind ends are abutted against each other and a circular end-to-end suture of the bowel done by interrupted mattress sutures of fine silk. This leaves the ileum closed by a double diaphragm. The loop of ileum just above the ileocecal valve is selected for this purpose, and then the gut, about two inches proximal to the closure, is brought up and fastened in the wound, to be opened some hours later and have a tube placed in it. This establishes the ileostomy and the colon exclusion. The appendix is then brought up through a separate incision and used as an opening to irrigate the colon. Should the appendix not be available a cone of cecum may be used. Later, when ready for closure, the plan is to introduce a knife downward from the ileostomy opening, perforate the double diaphragm of the Halsted closure and then close the ileostomy.

Summary. 1. Chronic ulcerative colitis is an obstinate, recurrent and dangerous condition.

2. When it resists medical treatment or becomes severe, operative attack is indicated.

3. Ileostomy and separate appendicostomy for colon irrigations, with exclusion of the colon from function, offers best results.

A brief report of three cases treated by ileostomy follows:

Case I.—A. J. L., white, male, aged thirty-nine years, admitted, July 10, 1920, to the Johns Hopkins Hospital. Past history unimportant. Present illness began three years before admission, with gradual onset. Had pneumonia in November, 1917, perhaps influenzal. In January, 1918, bloody diarrhea began, at first without much pain. Some mucus in stools. In April, 1918, amebæ found in stools, said to be amebæ coli. Was treated with emetin and seemed to be well for six months, but still had a little trouble, tenderness over descending colon and 2 or 3 soft stools daily. After six months, return of diarrhea and amebæ found again. Continued treatment by emetin and quinine injections through the rest of 1918 and 1919. In February 1920, symptoms became worse in spite of treatment, and has had constant diarrhea since; 10 to 12 stools daily. Proctoscope showed numerous ulcers of appearance of secondary pyogenic infection. After three weeks' treatment on medical service, transferred to surgery. On August 6, 1920, a transverse ileostomy was done by Dr. W. A. Fisher, Jr. Following this the bowel was irrigated with quinine, ipecac and neosalvarsan in dilute solutions for a period of several weeks. There was prompt and marked improvement. Symptoms entirely disappeared. Gain in weight. Disappearance of blood and mucus from bowel washings. Proctoscope showed ulcers entirely healed. On October 19, 1920, two and a half months after the ileostomy, the fistula was closed and the alimentary tract reëstablished by ileocecostomy. Patient was discharged November 10, 1922, having gained 45 pounds since ileostomy. Has been followed since and has remained entirely well, with a final and sustained gain in weight of 60 odd pounds. No further symptoms of bowel trouble since operation for a period now over two years.

Case II.—Dr. K., white, male, aged thirty-three years. Past history: Appendectomy for acute appendicitis. Otherwise not important. Present illness began in autumn of

1916, while the patient was serving with the National Guard troops on the Mexican border. Onset rather acute with diarrhea, blood and mucus being passed in large quantities. Rapid loss of weight and strength. After treatment for some time in army hospitals with gradual improvement, he was sent home to Baltimore on sick leave. Examination then showed typical appearance of amebic ulceration in the colon and amebæ were found in stools. Under emetin and quinine irrigations patient improved considerably but never was entirely well and had periods of recurrence of more severe symptoms. These were so disturbing that in 1919 he underwent several weeks of careful and rigid medical treatment in a hospital. He was much benefited, and for three or four months seemed well. However, recurrence then developed, and for two more years he suffered more or less constantly varying degrees of illness. In 1921 his symptoms became severe, with 12 to 15 bloody stools daily, marked loss of weight and great abdominal and fectal pain. He accepted the suggestion of ileostomy. Operation was done at the Union Memorial Hospital, October 28, 1921, a loop of ileum about fifteen inches above the ileocecal valve being brought into a right rectus incision, fixed there and transversely divided the next day. The upper arm of this loop constituted a fecal fistula and the lower arm was used to irrigate the colon. Salt solution, dilute silver nitrate, ipecac, neosalvarsan and yeast solutions were used in turn. The patient's symptoms began to improve abruptly after operation, and he gained about 20 pounds even while the ileostomy was open and the colon out of function. In January 31, 1922, the patient had been free of blood, mucus or pus, even microscopically, in colon washings for several weeks, and the ileostomy was resected and intestinal continuity established by lateral anastomosis. Since the ileostomy, now over a year, the patient has been free from any symptoms whatever, has gained permanently some 30 pounds and has not lost any time from his occupation.

Incidentally, he was able to do work for several weeks of the time between his ileostomy and the closure of it.

Case III.—Mr. L. S., white, male, aged thirty-two years. Past history negative except for pneumonia in 1905. Present illness began in June, 1921, with diarrhea and severe abdominal cramps. Under medical treatment there were short intervals of improvement, but prompt recurrences, severe enough to prevent the patient from working steadily. In January, 1922, he was sent into the hospital and stayed one month on medical treatment; rest in bed and irrigations. Left the hospital much better. In May he had a recurrence of severe type. June 9, 1922, appendicostomy. Much better, and while irrigations continued, he had little trouble. Discontinued irrigations in August. Appendicostomy closed spontaneously in October, 1922. Recurrence of symptoms in severe form soon after. Loss of 12 pounds in eight days. Bloody stools, 15 to 20 daily, and a great deal of abdominal pain. Transverse ileal closure by Halsted end-to-end method, ileostomy above and reopening of appendicostomy on November 13, 1922, at Church Home and Infirmary. Immediate relief of pain, diarrhea and bleeding. No passage from the colon except with salt solution irrigations.

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CHRONIC OBSTRUCTIVE JAUNDICE: A REPORT OF NINE CASES TREATED BY CHOLECYSTO-GASTROSTOMY

By William A. Downes, M.D.
New York

It is unusual for growths involving the head of the pancreas to produce obstruction to both the common bile duct and the duodenum to such a degree that if benefit is to be derived from an operation it will be necessary to drain the stomach as well as the biliary passages. For this reason, it seems worth while to record the history of a patient suffering from such a growth in whom symptomatic relief was obtained by combining cholecystogastrostomy with gastrojejunostomy. At the same time I wish to review briefly the histories of 8 other patients operated upon for the relief of chronic obstructive jaundice. If it is possible to establish suitable drainage sufficiently early in these cases, symptoms resulting from the obstruction will be relieved, but the final outcome will depend upon the nature of the primary disease. Should chronic pancreatitis or other non-malignant condition be the cause, a cure may result. Fortunately, in nearly all cases of non-calculous obstruction to the common bile duct, the gall-bladder is large and freely movable. The walls are usually in good condition and an anastomosis to some part of the intestinal tract, preferably the stomach or duodenum, is a fairly simple and safe procedure. Diseases producing the symptoms for which this type of operation is advised or under-

taken are often malignant in character, and for this reason these operations are usually referred to and generally thought of as palliative operations.

Since the diagnosis in many cases of chronic jaundice remains in doubt even after the abdomen is opened, because it is not always practicable or even desirable to remove a portion of tissue for microscopical examination, a supposed palliative operation may prove to be a curative one. The symptoms are relieved and the individual restored to health, while Nature in some way makes provision for the disabled organ causing the trouble. The final outcome in every case of obstructive jaundice, unless relieved by operation, is so certain that all those in reasonably good condition deserve the benefit of an exploratory operation. The first case in this series was operated upon four and one-half years ago. The anteoperative diagnosis was common duct obstruction, probably due to stone. At operation the gall-bladder and common duct were greatly distended, but no stones were found. The pancreas was moderately enlarged, nodular and stony hard throughout. The diagnosis was made of carcinoma of the pancreas. This patient made an uninterrupted recovery. Jaundice disappeared entirely in three weeks, and he remains well to the present time. It is very evident that we had to do with a chronic inflammatory condition and not a malignant one.

Since operating upon this patient I have performed cholecystogastrostomy eight times for the relief of chronic obstructive jaundice: 4 of the 9 patients suffered one or more attacks of pain; 2 of these had calculi in the gall-bladder; 1 a number of small stones and the other a single large stone. In none of the cases was a stone found in the common duct. The gall-bladder and ducts were distended in all cases—some to only a moderate degree and others enormously. The walls of the gall-bladders were described as thinned or thickened in varying degrees. The

pancreas showed definite pathological changes in 8 of the cases: In 2 cases it was symmetrically enlarged throughout. In 1 the midportion was the seat of a bulky tumor. In 1 the head was thickened but smooth, and there were areas of yellowish subperitoneal fatty deposits suggestive of fat necrosis. In 4 instances it was stony hard, nodular and irregular. On 2 occasions it was thought that a separate nodule could be palpated at the location of the diverticulum of Vater, but these observations were not verified by exploratory incision into the duodenum. In 1 case the pancreas appeared to be perfectly normal and the obstruction was found to be due to an anomalous vessel, an artery about the size of the radial, which crossed the common duct just as it disappeared behind the duodenum. The jaundice was classed as moderate in 5 cases and severe in 4. Its duration was from three weeks to three months, except in the case with the anomalous vessel, in which it had been intermittent for over a period of ten years. Weakness, loss of weight and digestive disturbance either preceded or soon followed the jaundice. Nausea and vomiting occurred to a certain extent in all cases, but in one instance was so severe that the patient was unable to retain food of any sort. 2 patients gave a history of chills and fever, and itching was a distressing symptom in 5.

During the period of time in which these 9 patients were observed a number of other cases of chronic jaundice were operated upon for one cause or another, but, as the methods adopted were different, the histories are not included in this report. Suffice it is to say that in all cases in which an anastomosis of the gall-bladder to the intestinal tract seemed to offer the hope of draining the bile passages, cholecystogastrostomy was performed. The stomach was chosen as the site for the anastomosis for the reasons that it is easier and safer in the average case to suture the gall-bladder to this viscus than to the duodenum. All 9 cases in which this operation was done made good operative

recoveries. Technically the operation offered little difficulty, as the gall-bladders were large and freely movable, the fundus lying over the pyloric end of the stomach at about the point where the union should be formed.

As to the technic, the gall-bladder is aspirated and a transverse incision one and one-half inches long is made just below the apex of the fundus. This opening is united by three rows of sutures to one of a similar length in the stomach just proximal to the pylorus. No clamps are used. Use of the suction apparatus aids greatly in keeping the field clean. Apparently the condition of the gall-bladder wall, that is, as to whether it is thick or thin, is not material in so far as obtaining union is concerned.

The convalescence of most of these patients was unusually smooth. The presence of bile in the stomach did not cause discomfort or increase the tendency to postoperative vomiting. As a matter of fact, the bedside notes show that 5 patients did not vomit following the operation; 2, only once; 1, several times during the first week, and in 1 there was considerable vomiting on the twentieth day. This patient developed an acute dilatation of the stomach which was promptly relieved by lavage. It is a general observation of all surgeons who have performed cholecystogastrostomy that the passage of bile through the stomach is harmless. The average stay of the patients in the hospital was twenty-six days. At the time of discharge the jaundice had entirely disappeared in all but 1. This was undoubtedly a case of carcinoma of the diverticulum of Vater, with almost a mahogany color; a slight tinge remained on the twenty-fifth day.

The general symptoms, such as itching, dryness of the skin, nausea and vomiting, were entirely relieved. There was marked improvement in the strength of all but 2. The histories of the patients since leaving the hospital is as follows: 4 perfectly well—1 at four and one-half years, 1 at nearly four years, 1 at two years and eight months,

and 1 at eight months; 1 died at the end of one and one-half years. This man had resumed his work as a carpenter and was apparently in good health. He died suddenly following an unusual effort. 2 died four months after operation from extension of the disease. The 2 remaining cases (numbers eight and nine) have been operated upon too recently to venture an opinion as to the outcome.

Case 8 (Hospital No. A, 31806) is the one in which there was obstruction to the descending portion of the duodenum as well as to the common bile duct. A brief history of this case is as follows:

F. T., aged fifty-six years. Admitted to St. Luke's Hospital, September 14, 1922. Discharged October 16, 1922.

Chief Complaint. Nausea, vomiting, weakness and itching of skin.

Present Illness. Began about six months ago with indigestion and a tendency to tire easily. Careful examination at that time, including a barium meal, was negative in every way except for the presence of slight anemia. Early this summer he went to Scotland, and although he suffered from a severe attack of diarrhea on the way over, he was much improved. In August, however, indigestion became worse and was soon followed by nausea and vomiting, so that by the time he returned home (September 1) he was unable to take or retain solid food. About this time jaundice appeared and has gradually increased up to the present time. Recently, itching has become so troublesome that it keeps him awake at night. Urine very dark, stools clay-colored. No pain at any time. Lost 20 to 30 pounds in weight.

Past History. Negative except for chronic constipation and occasional attacks of indigestion.

Physical Examination. Patient is a well-developed man,

appearing chronically ill. There is evidence of loss of much subcutaneous fat. The skin and sclera show a marked yellowish tinge. Head and neck normal. Lungs clear. Heart not enlarged. No murmurs. Abdomen normal contour. No fluid. Liver and gall-bladder not felt. There is a definite mass, about two by three inches, which is hard and movable, just to the right of the median line at about the normal location of the pancreas. Extremities normal. Laboratory findings: Red blood cells, 4,704,000; hemoglobin, 50 per cent; white blood cells, 70 per cent; polymorphonculears, 70 per cent; neutrophiles, 30 per cent; morphology normal. Wassermann negative. Urine negative. Stool positive for blood.

Summary of Roentgen-ray Findings. There is a lesion involving the pyloric end of the stomach and second portion of the duodenum with a twenty-four-hour retention of barium in the stomach and duodenum. The possibility of a pancreatic lesion should be considered. These findings would merit surgical exploration.

Operation, September 21, 1922. Diagnosis: Carcinoma of the head of the pancreas, obstruction of the common bile duct and second portion of the duodenum.

Pathological Findings. Gall-bladder and common duct greatly distended. Head and body of pancreas hard, nodular and enlarged. Duodenum normal to the feel, but the descending portion was fixed to the pancreas. Liver appeared normal. The gall-bladder did not contain stones nor could stones be palpated in the common duct.

Operative Procedure. Cholecystogastrostomy—gastrojejunostomy (Murphy button). The gall-bladder was united to the anterior wall of the stomach just proximal to the pylorus by three rows of sutures—the two outer rows of silk and the inner of chromic catgut. Before completing the anastomosis one-half of a Murphy button was dropped into the stomach. The posterior wall of the stomach was then exposed through a small opening in the transverse

mesocolon and the anastomosis to the jejunum rapidly completed by the use of the button. Blood transfusion was given on the fifth day postoperative. Convalescence slow but satisfactory. Clear of jaundice at the end of three weeks. Did not vomit following the operation and is now able to take all sorts of food. Two weeks after discharge from the hospital there was a definite increase in the size of the pancreas accompanied by pain in the back. The patient was then referred by his physician to Dr. Pfahler, of Philadelphia, for deep roentgen therapy. Under this treatment there has been marked reduction in the size of the growth with general improvement in health.

In 1916, Erdmann and Heyd[1] reported a case in which cholecystogastrostomy and gastrojejunostomy were performed at one operation. The patient was in good condition six months later. More recently, Spencer,[2] of London, described a case in which cholecystoduodenostomy was followed in three weeks by gastrojejunostomy and the man lived for five years, dying of scirrhus cancer of the pancreas. Such results in a class of cases usually looked upon as hopeless warrant the risk involved in undertaking operations of this gravity.

In going over the histories of the cases forming this report and checking up the findings at operation with the subsequent history of the individual patient, I am very much impressed by the fact that in only 3 out of the first 7 operated upon was I able to prognosticate the outcome with a fair degree of certainty. Ordinarily the failure to differentiate in less than 50 per cent of cases a malignant from a non-malignant tumor by the feel would be embarrassing, but if one recalls the variations in size, density and shape of the apparently normal pancreas such mistakes are more easily forgiven.

Certain steps over a period of days are of great value in the preliminary preparation of these patients for operation—such as forced fluids by mouth if possible, glucose

solution by rectum and saline solution under the skin. It is important to have the blood grouped and be prepared to give blood transfusion either before or after operation. Furthermore, it is very important to avoid unnecessary trauma during operation. Explore the abdomen and palpate the various organs with great care. Hemorrhage started from lacerating the tissues or from the forcible separation of adhesions may be difficult or impossible to control. When in doubt do not explore the common bile duct or duodenum—better to leave an occasional stone than to lose the patient searching for it. Personally, I doubt the wisdom of ever cutting into the pancreas in deeply jaundiced patients for the purpose of removing specimens for pathological examination. Such incisions serve no useful purpose so far as the individual is concerned, and may lead to irremediable harm.

In conclusion, all patients suffering from chronic obstructive jaundice should be operated upon, as surgery offers the only hope of relief. Internal drainage of the bile ducts is preferable to external drainage in the same way that it is desirable, when possible, to anastomose around inoperable growths in the intestine, in order to avoid the formation of an artificial anus. The slightly greater risk involved in anastomosing the gall-bladder over simple drainage is more than offset by the increased comfort of the patient plus the added advantage of retaining the biliary secretion. Besides, in the event of a cure by external drainage a secondary operation is necessary in order to close the fistula. Personally, I have found it easier to unite the gall-bladder to the stomach than to the duodenum, and since the passage of bile through the stomach is harmless, consider cholecystogastrostomy the operation of choice.

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DISCUSSION

Dr. Charles R. Robins, Richmond, Va.—I have been very much interested in Dr. Downes' paper, and I do not propose to discuss the technic of the operation he has described; but I would like to call attention to a field of usefulness for this type of operation which I think is probably going to develop into an important one.

We have had quite a little experience in treating malignant diseases with deep roentgen-ray therapy, which is done by a specialist in that line, and I am not going to speak of the method, but the point is that we have been able to secure some very remarkable results by this method of treatment.

I have had one case that made quite an impression upon me, a case of carcinoma of the pylorus, in which the closure was practically complete and in which the operation of gastroenterostomy was done, and the case then followed by deep roentgen-ray therapy. At the time the man was operated on he had a palpable growth, but under this treatment the growth disappeared entirely and he lived for fifteen months after the operation was performed.

My own experience in doing gastroenterostomies for malignant disease had been disappointing as to the length of time the patients had lived after operation, and I believe that this particular case would have gone rapidly on to death. The man had at least a year added to his life, if not more. He was able to eat anything he wanted. He would always make an exception to pickles, but he had no necessity for controlling his diet in regard to anything else. He lived happily and comfortably.

The point I wish to make is that an operation that will enable the patient to carry on the functions of the body while the growth itself is being treated by roentgen ray will develop a wide field of usefulness.

Dr. Francis G. Du Bose, Selma, Ala.—I want to thank Dr. Downes for this splendid paper, for it really opens up a new field. I am perfectly honest in saying that all of us do things of which we are a little ashamed and oftentimes afraid.

In 1913, an old lady came to me with obstructive jaundice on whom I had operated twice. First in 1911, for the removal

of gall stones in the gall-bladder, and the next time in 1912 for stones in the common duct. She had obstruction in the common duct at this time, in 1913. I attempted to expose the common duct, found the wall of the gall-bladder and we dissected it loose and did a cholecystoduodenostomy. I said that if she has an infective cholangitis as a result she will die a natural death. She has had no trouble since. The old lady is now eighty years of age; is living and in good health.

Since that time we have done 7 cholecystoduodenostomies, and these 7 patients are doing so well that my confreres are beginning to notice in the follow-up work that none of them have shown bad results.

THE TREATMENT OF ANTHRAX INFECTIONS

By Alexius McGlannan, M.D.
Baltimore, Md.

(Read by Title)

Anthrax forms a small but distinct professional risk to workers in hair and bristles (0.296 and 0.029 per cent respectively[1]). It is also found occasionally among those people whose occupations bring them into direct contact with living or dead animals. It has come into prominence lately because of the danger of its dissemination through the use of infected brushes.

The serious and often fatal disease is quite common among animals except in those countries where special precautions are taken to prevent the spread of the disease and to secure proper disposal of infected carcases. One of the many brilliant results of Pasteur's work lives in the relative freedom from the disease existing among the animals of France. From the animals, infection reaches man by way of the highly resistant spores which contaminate the crude hides and hair of commerce, as well as the carcases of animals dead from the disease. Infection may be carried by the worker in one of these industries to individuals not otherwise exposed.

The usual portal of entry in human beings is through an injury to the epidermis. In one type, the woolsorter's disease, infection takes place by inhalation of the bacteria; and there is an intestinal type in which it is probable that the food is contaminated with the spores, most likely from

dirty hands. My experience is limited to cases of cutaneous anthrax.

The skin lesion begins as an insignificant wound or abrasion through which infection occurs. A period of incubation, varying in length from a few hours to three days, is followed by local burning or itching and the development of a papule having a bluish-green center. This lesion and the symptoms resemble those following an insect bite. The papule soon becomes vesiculated, the contents of the vesicle being hemorrhagic or serous. The vesicle breaks down and forms an erosion in which a purplish-black area of leathery necrosis is set into the papule and separated from the red indurated rim of the lesion.

The anthrax papule or pustule is relatively painless, a feature which distinguishes it from furuncle and carbuncle.

The transition from the primary papule to the malignant pustule may occur in a few hours, or it may be possible to separate the progress of the lesion into three stages, which occupy from four to six days for complete development[2]:

1. The period of incubation, lasting for two or three days.
2. The development of the papule and vesicle, lasting from twenty-four to thirty hours.
3. The stage of central necrosis with local induration, circumscribed edema and vesiculation, lasting from one to three days.

In man, usually, there is a vigorous local reaction to the infection, which may result in a distinct tendency for anthrax to remain localized. In rare instances, after ten days, spontaneous demarcation and sloughing of the gangrenous pustule may occur, leaving an ulcer which heals slowly.

Often edema develops about the pustule and spreads rapidly. The extent of edema depends largely on the character of the tissues in the neighborhood of the primary lesion, and usually resembles a diffuse cellulitis with many blisters on the surface. The lymphatic vessels are inflamed and the draining lymph nodes become swollen and indurated.

The development of a localized pustule indicates a degree of resistance to the bacteria, while a widespread edema is evidence of failure of the tissue to prevent the advance of the infection. However, the bacteria may pass directly from the pustule into the blood and give rise to a septicemia.

There is some controversy regarding the immediate effects of anthrax inoculation. Hiss and Zinsser[3] inoculated the tails and ears of guinea-pigs and were unable to prevent general infection by immediate amputation. The observers conclude from these and other experiments that, although the bacilli are not demonstrable in the blood until just before death, they nevertheless invade the blood and lymph streams immediately after inoculation and are conveyed by them to all the organs. The bacilli proliferate at the point of inoculation and probably in the organs, until the resistance of the infected animal is entirely overcome. At this time the bacilli are able to grow in the blood stream.

Other experimenters contend that cutaneous anthrax always begins as a local infection, with the bacteria confined to the lesion or its immediate vicinity. The clinical course of many cases, particularly those showing an indurated pustule with little or no surrounding edema, is evidence in opposition to the conclusions of Hiss and Zinsser. There may be some essential difference in reaction to various methods of inoculation, as there certainly is a difference in the susceptibility of various animals.

The method of action of the anthrax bacillus in the body is not as yet definitely known. Hiss and Zinsser suggest that death is brought about to a large extent by purely mechanical means, such as capillary obstruction. Boidin is credited by Lecene with having extracted from anthrax bacilli an endotoxin capable of producing local edema when injected into animals. Hiss and Zinsser assert that neither a true secretory nor an endotoxin has been demonstrated for the anthrax bacillus, but admit that the clinical picture

of the disease makes it impossible to conclude that such a poison does not exist.

Whether or not the disease is localized or general at its onset has an important bearing on the rational method of treating the patient. If there is a recognizable period in which the bacteria are confined at the point of inoculation, complete excision of the primary focus during this period is the surest and most rapid method of preventing general infection. If, on the other hand, the bacteria spread throughout the circulation at the moment of inoculation, systemic treatment by specific serum injections is the proper method.*

If the number of bacteria reaching the circulation is small and the active proliferation is limited to the region of the portal of entry, excision of this primary focus combined with injection of the serum into the blood appears to be a reasonable method of combating the disease at the time such relation of infection and resistance exists.

When extensive edema, lymphatic enlargement and symptoms of general infection have developed, serum therapy alone is indicated. At this stage of the disease nothing can be gained by excision of the primary focus and much harm may be done by opening new avenues for extension by cutting into the infected area.

I have had opportunity to treat 6 cases of anthrax. All the patients recovered. In 4 the lesions were distinctly localized, in a fifth there was spreading edema, and in the other case there were symptoms of general infection. All were cases of industrial anthrax. The credit for the good results obtained is due to Dr. Asa Wessels, physician to the factory, who recognized the lesions as soon as he saw the patients and promptly sent them for treatment. In all cases the anthrax bacillus was demonstrated in the lesion.

* Eichhorn, of the United States Bureau of Animal Industry, has developed a serum of great potency. Serum prepared by his method is now available through the commercial manufacturers.

Regan[4] advises the use of the Eichhorn serum, both locally and intravenously, to the exclusion of all forms of treatment. His reasoning is good and he shows the effectiveness of the method in the hands of Symmers and others. It may be that, with the existing uncertainty regarding the mode of invasion by the bacillus, local and general serum therapy is the best means of treatment, although the good results obtained in our small series of cases seems to indicate the value of early, complete excision of accessible primary foci.

The following is a short summary of the 6 cases:

Case I.—August, 1909. Circumscribed pustule on the right arm. The patient was a white man, aged forty years. The primary smarting and vesicle was noted about forty-eight hours before he reported to the physician. The pustule was about $\frac{3}{8}$ inch in diameter, with a black center and an indurated narrow red border. Anthrax bacilli shown on the cover-slip. There was no swelling or tenderness of the lymph glands and no lymphangitis. Temperature was normal. Under ether the involved area was excised and the wound was left wide open. The patient returned to work in thirty-seven days.

Case II.—June, 1912. Circumscribed pustule on neck. The patient was a white man, aged fifty-two years. The lesion was nearly three days old when he reported for treatment. The pustule was about half an inch in diameter, with typical dark center and red rim. Anthrax bacilli demonstrated in smear. There were no signs of lymphatic involvement and no fever. Under ether the involved area was excised with the electric cautery. The patient returned to work in thirty-six days.

Case III.—June, 1920. Circumscribed pustule in the right forearm. The patient was a white female, aged thirty-five years. The lesion had been present four days

at the time of treatment. It was a typical, circumscribed malignant pustule, and the bacilli were recognized in the smear. There was no edema about the pustule and no evidence of lymphatic involvement. The temperature was normal. Under nitrous oxide the lesion was excised with the cautery. The patient recovered without any complication.

Case IV.—April, 1922. Circumscribed papulopustule on the left arm. The patient was a white female, aged sixteen years. The lesion was three days old at the time of admission to the hospital. The eroded vesicle at the summit of the papule showed an area of dark necrosis about the size of a pin-head. The bacilli were recovered from the lesion. There were no signs of extension beyond the immediate area involvement. Under nitrous oxide the lesion was excised with the cautery. The patient recovered without any complications.

Case V.—March, 1911. Malignant pustule of right temple, with edema of the face. The patient was a white man, aged sixty years. The lesion had been present three days when he was admitted to the hospital. The pustule was small, about ¼ inch in diameter, and had a typical black center without much induration at its border. The edema was a little brawny and involved the scalp, the forehead, the eyelids and the cheek. The glands of the neck were not tender, nor were they enlarged, and there was no evident lymphangitis. The bacillus was present in smears. The patient was kept in bed. The surface of the pustule was disinfected with pure carbolic and alcohol several times a day. The slough separated, the edema gradually subsided, until on the sixteenth day there remained only the indolent ulcer which marked the location of the pustule.

Case VI.—May, 1920. Malignant pustule on the nose, with general infection. The patient was a white man, aged

thirty-five years. The primary lesion was a small pustule on the nose, which had been present forty-eight hours. The black slough was partly separated. The entire face and both sides of the neck were greatly swollen and brawny. The edema involved the scalp, closed the eyelids and filled out the recession of the neck under the angle of the jaw. The lymph glands were swollen and tender. The temperature was 104°. There was marked dyspnea and the skin was purplish red in color. Blood cultures proved negative, but anthrax bacilli were recovered from the pustule by smear and by culture. 30 cc of antianthrax serum was given intravenously. The pustule was kept covered with small sponges of gauze wet with mercurochrome solution. In the next twenty-four hours considerable improvement took place in the general condition of the patient, but he still had fever of 102° and the edema was very slightly diminished. Another 30 cc of serum was injected intravenously. The temperature fell to 99.8° in the next eight hours, and gradually falling remained normal after the fourth day. The bacilli were found in smears from the pustule for five days, after which time they disappeared. The swelling of the neck subsided rapidly after the fourth day. The pustule gradually dried up and on the tenth day was represented by a small scaly area on the nose. The patient was discharged cured on the fourteenth day.

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THE RESULTS OBTAINED IN ELEPHANTIASIS THROUGH THE KONDOLEON OPERATION

By Walter E. Sistrunk, M.D.
Rochester, Minn.

Experience with the Kondoleon operation leads me to believe that it may be looked on as a definite means of controlling the progress of elephantiasis, although it is not always possible through it to restore the limb entirely to normal. Until this operation was suggested, little could be done surgically for elephantiasis, and in the majority of patients the disease slowly progressed until the limb became tremendously enlarged and deformed.

Elephantiasis is probably caused by a streptococcic invasion of tissues, and usually develops in tissues in which there is lymphatic or venous obstruction. In many of our cases a history of such an obstruction has been obtained. Following the obstruction lymphedema usually develops, and after a lymph stasis is present in a limb, infection in the tissues seems more probable. A history of definite infection through an open wound has been obtainable in a number of instances. In certain cases injury to the limb with probable phlebitis preceded the disease. In others no etiological factor could be obtained.

All the patients operated on gave histories of lymphedema which preceded the elephantiasis. If lymphedema is allowed to exist without efforts to control it by means of bandaging and so forth, the edema usually increases slowly and in certain cases, probably through infection, a tre-

mendous increase in the fibrous tissue elements of the skin, subcutaneous tissue, aponeurosis and superficial lymphatics occurs until the condition gradually changes to one of elephantiasis.

Many patients with elephantiasis eventually develop recurring attacks of erysipelas, and each of these attacks tends further to increase the difficulty in drainage, probably because of destruction of lymphatic vessels and increase of the fibrous tissue elements of the skin and subcutaneous tissue.

Elephantiasis involves only the superficial tissues, and even in advanced cases the tissues lying beneath the aponeurosis are normal. In 1912, Kondoleon, following ideas previously advanced by Lanz, Oppel and Rosanow, conceived the idea of treating elephantiasis by connecting the deep and superficial lymphatics by the removal of a large amount of aponeurosis. He also removed as much skin and superficial fat as could be removed and still allow closure of the skin edges. The deep aponeurosis separates the deep and superficial lymphatic circulations, and after it has been partially removed and the skin allowed to drop down on the muscles, new bloodvessels and new lymphatics form. These new vessels connect the two circulations, and the deep circulation thus drains the stagnated lymph from the superficial circulation.

The operation is usually performed as follows: A long, modified, elliptic incision, which includes the skin to be sacrificed, is made on one side of the affected limb. On the outer aspect of one of the lower extremities this incision extends from the crest of the ilium to a point a little below the external malleolus of the fibula. Then, in order to facilitate a wide removal of the subcutaneous fat, the skin is reflected on each side of the incision for a distance of about 3.75 cm. The skin is retracted and underneath each of the edges of reflected skin a long incision is made through the edematous subcutaneous fat down to and including

the aponeurosis. These incisions are made almost parallel with the original skin incision. Included between them is a quadrilateral piece of edematous fat and aponeurosis. At their upper ends the two incisions through the aponeurosis are connected by a transverse incision. The tissues to be removed are now free except for the attachment of the aponeurosis to the underlying muscle. By traction on the tissues to be removed it is easy to dissect the aponeurosis from the muscle throughout the length of the entire limb and to remove in one long piece the skin, edematous fat and aponeurosis. A number of vessels which tend to bleed profusely are encountered; these are controlled temporarily with forceps. After the tissues have been removed these forceps are taken off and surprisingly few of the vessels will be found to need ligature. The wound is closed with interrupted silkworm gut sutures, without drainage. It is usually necessary to perform a similar operation on the opposite side of the limb. The incision for this second operation should extend from the extreme upper portion of the inner surface of the thigh down to a point a little below the internal malleolus of the tibia.

My experience in operating for this disease has brought out certain facts which should be borne in mind in attempting to obtain the best results. The ease with which the operation may be performed is increased if means are first taken to allow the edema to subside. If the patient is placed in bed with the limb elevated and firmly bandaged, and is kept in this position for ten days or more, the limb usually diminishes considerably in size and the tissues become softer. It is then easier to determine at operation the amount of skin which may be sacrificed and still permit satisfactory closure of the skin edges, and it also appears that the vascularity of the parts is diminished by such preoperative treatment. Many patients seek medical aid at a time when a low-grade streptococcic infection is present in the tissues, and it seems especially important in such cases

that preoperative treatment of the type mentioned should be used until the redness and evidences of active inflammation in the tissues have subsided.

When patients do not obtain a satisfactory reduction of the limb by the first operation, it is possible to obtain further improvement by a subsequent operation for the removal of diseased tissue and obstructed lymphatics. We have found that much is to be gained by the continued removal, if necessary, of thickened and deformed areas. The repeated excision of such areas eventually removes large amounts of diseased tissue and allows the formation of new bloodvessels and lymphatics, which assist in draining the affected limb. Operations of this type were probably first recommended by Rogers, of Milwaukee.

Considerable shock follows the operation in some patients, probably on account of extensive injury to sensory nerves and because of bleeding, and for this reason it seems wiser, in extensive cases, to perform the operation on one side of the limb only. The opposite side may be operated on ten or twelve days later. To diminish shock, patients are given $\frac{1}{6}$ gr. morphine before operation, and after operation are treated as in shock; the head is lowered, external heat is applied and subcutaneous salt solution and repeated hypodermics of morphine are administered.

Patients should bandage the limb for an indefinite period following the operation. This usually easily controls the swelling even when patients are up and around, whereas such a procedure before the operation would have failed to control the swelling. Should the limb swell too much in spite of the bandaging, the patient should be advised to stay in bed for periods of a week at a time, or longer, and during this time to keep the limb elevated and firmly bandaged. Such treatment usually diminishes the edema and, after this has disappeared, bandaging more effectively prevents further swelling.

Before operating it is advantageous to have a distinct

understanding with patients regarding the prospects for cure. They should clearly understand that although the size of the limb will be diminished by the operation a perfectly normal limb is not to be expected; that the operation is being done to control a disease which, if left untreated, will grow progressively worse, and that it will be necessary to keep the limb bandaged for an indefinite period following operation.

I have operated on several patients who have been unsuccessfully operated on by other surgeons, and in each instance a good result was obtained by the second operation. The first operation failed probably because the surgeon had not observed the principles which I have outlined.

Several patients developed recurring attacks of erysipelas some time after operation. In such cases a streptococcic vaccine should be administered over a long period of time, and any foci of infection which might be present should be eradicated. I would strongly advise, also, that this vaccine be given, as a postoperative measure, to all patients who have had attacks of erysipelas or cellulitis prior to operation.

I have now operated on 40 patients by this method: 30 of the 40 patients operated on obtained good results; the remaining 10 are improved. I believe that by means of further operative procedures a good result could be obtained in each of these.

DISCUSSION

Dr. Herman B. Gessner, New Orleans, La.—Dr. Sistrunk deals with a condition which does not shorten life but makes it less attractive and comfortable.

As announced in the paper, the original discussion of this subject took place when Dr. Rudolph Matas, in 1913, presented it to the Louisiana State Medical Society at Baton Rouge. He reviewed the subject at the time, calling attention to the points

in etiology which Dr. Sistrunk has emphasized. He called attention to the fact that repeated attacks of streptococcus infection led to a blocking of the lymph trunks. Dr. Matas at the time included my own initial case. It is interesting to note that this method of therapeutic procedure came to us from Greece. Kondoleon was a Greek surgeon practising in Athens.

Our experience has been the same as that of Dr. Sistrunk, namely, that the condition is usually not entirely cured. A very valuable point brought out by the essayist is the importance of secondary treatment of these cases by bandaging. It is remarkable how people at times develop blocking of the lymph trunks which cannot be explained by streptococcus infection. Three or four years ago I saw a man who was laid up in a hospital with one limb in a state of lymphedema. We worked over him carefully, could not find an explanation and concluded there was something in his pelvis blocking the lymphatics. We could not identify it. I did not see him after that. A few months ago, last summer, I met him; he spoke to me rather regretfully, saying that I had given him a vague opinion of his case, so he went to another doctor, and the other doctor suspended his leg and proceeded to bandage it. The continuous support of his tissues by means of bandaging has apparently relieved him entirely of his lymphatic trouble. The case reminds me of a patient who at first had infection of the arm, a vaccination infection and then an infection in the lymphatic vessels of the lower extremities. The case illustrates the great benefit to be derived from persistent bandaging.

Those who have seen Dr. Sistrunk do this operation can testify that the beautiful illustrations shown here correctly represent a splendid piece of technic.

Dr. Hubert A. Royster, Raleigh, N. C.—As I happen to have operated upon the next case following those of Dr. Matas and Dr. Gessner, I may be permitted to say that all the knowledge I have of this operation came from Dr. Matas' paper, which he kindly sent to me, just before my case came into the hospital, otherwise I think the victim would have had his leg amputated. At any rate, that is what he came for.

I can testify to the good results of the Kondoleon operation, and I can also join both speakers in saying that infection, whatever it may be, is one of the chief concerns before, during and after operation.

Dr. Matas mentioned in his paper the use of a polyvalent serum, and also the use, if I mistake not, of thiosinamin, which is the active principle of mustard, in having a specific action on the reduction of indurated tissue, if given previous to operation and afterward.

I have learned from Dr. Sistrunk the value of rest in bed. We did not resort to prolonged bandaging, unfortunately, in my case, not knowing its value. We did wait for permission to operate on the patient, whose consent we did not obtain in less than two weeks.

The anastomosis which is obtained between the superficial and the deep lymphatics, as has been said, is the keynote of the situation. I believe that the extension of this principle by the essayist to other forms of lymphedema, not strictly elephantiasis, has been an advance. We should also remember that apparently none of this has to do with the old elephantiasic condition which has been supposed to be concerned with the *filaria sanguinis hominis.* Apparently that plays no part in it. What does play a part is recurrent infections of the limb, and we have to undertake the treatment of that before doing anything mechanically which may relieve it.

Dr. Francis Reder, St. Louis, Mo.—The unique character of these cases is certainly extraordinary, and the operative results obtained as shown by Dr. Sistrunk are extraordinary in the superlative degree.

I was pleased to hear Dr. Sistrunk refer to the erysipelatous condition so often associated with these cases. I also noticed that he called this condition a cellulitis. While I have not operated on a case of pronounced elephantiasis, I have operated on a class of cases closely allied to elephantiasis, known as lymphangioma. I look upon this inflammatory condition following operation as a phlegmonous one, the bacterial cause being usually the streptococcus.

I have noticed in using hot-water injections in these lymphangiomatous tumors, some of which were as large as a tangerine, where an excision was not advisable, that we have succeeded in reducing them to one-third their size after one injection. In a number of these cases a phlegmonous inflammatory condition followed, which gave me great concern. In connection with this I may say that the tension incisions made into the inflamed part were of no avail and usually complicated the seriousness

of the condition. The inflammation will subside with proper topical applications and rest. In some of these cases the chill is often absent, the temperature rises to 104° and 105° and a marked depression of the system is apparent. The patient appears very sick for the time being.

Dr. Sistrunk (closing).—With regard to Dr. Reder's question about erysipelas, we see two types of infection of these tissues, both of which are caused by the streptococcus. I have seen in many cases definite attacks of erysipelas associated with chills, high fever and a very marked inflammatory condition throughout the limbs, and a number of patients who have had the chronic type of infection, which is quite definite, with cellulitis, which is often extensive, but without the constitutional reaction which is characteristic of true attacks of erysipelas.

In these diseases the rest in bed and application of some solution, like aluminum acetate, will cause the inflammation to subside rapidly, and we are always careful to see that the tissues have lost their inflammation before attempting to operate.

COMPLETE HYPOSPADIAS, OR PSEUDOHERMAPHRODISM. REPORT OF A CASE

By Francis R. Hagner, M.D.
Washington, D. C.

This case is reported and the patient shown at a meeting of the American Association of Genito-urinary Surgeons, held in May, 1922.

As to the literature, only 25 cases have been reported and operated on. Carl Beck, who has had large experience in operating on deformities of the penis, never saw but one of these cases, and that case he did not operate on.

I know of a patient in West Virginia that had been attending a girl's school until eighteen years of age, and at this time it was found he was a boy. These cases, of course, are harmless as far as sexual intercourse is concerned. My patient was under observation from the time he was two years old, and for two weeks after birth was thought to be a girl. I will show the slides.

The present condition of the patient is as follows: He has perfectly straight erection of the penis; no incurvation, as the large flaps cause no tension. I can pass a 32 sound without trouble down to the membranous urethra, or a 22 sound will enter the bladder without trouble. The patient is now seventeen years of age. He plays baseball and football, stands up to urinate instead of sitting, and is now a real man.

DISCUSSION

Dr. Joseph E. Johnson, Memphis, Tenn. (by invitation).—This is a subject in which I have been considerably interested, as it has been my fortune to see quite a number of these cases.

I recall one patient who graduated from our high school in Memphis at the age of eighteen years, as a girl. It was when called upon to operate upon her for appendicitis, noting the heavy voice and the history of never having menstruated, that her general makeup attracted my attention. There was nothing in the pelvis. In this case there was a complete bifurcation of the scrotum, and the perineal opening of the urethra, which had been mistaken for the vagina; both testicles were in the scrotum. The first step of the operation was to remove the rudimentary urethra and reconstruct a urethra, which we did to the full length of the penis. The penis after being freed developed very rapidly, leaving an urethra two and a half inches back of the gland. We tubed a flap of the scrotum and turned it forward under the skin to exit at the normal site. This was left in position for a number of months, when the skin was raised and the two portions of the urethra were united. We now have a complete urethra and the scrotum is together and quite normal in appearance. He has since entered our profession.

At the present time I have under treatment five patients in the different processes of reconstruction for this particular condition. One of these children, aged four years, had an aunt, aged twenty-four, who was present and objected to the operation, stating that it was characteristic of her family to have this deformity, and that if this child was a male, she was a male. *She was!* In this case one testicle had descended, the other was in the canal. The family reported two uncles and an aunt with the same deformity. One of these, aged fifty-one years, I have verified personally as complete perineal hypospadias, with both testicles in the scrotum. The other uncle, I have been told by his family physician, has about the same condition. The aunt declines to have any examination, but has lived a life of what they speak of as "neutral sex."

The first consideration in treating these patients is to dissect off the rudimentary urethra which is holding down the penis, to allow the penis to develop and straighten out. The

penis should get its length before we reconstruct a urethra, as a skin urethra will not lengthen if the penis develops further.

Dr. Hagner reports that these cases are very rare, but from my experience I am not so impressed. This condition is analogous to the hare-lip and cleft-palate, which is nature's same accident, and I see no reason that some degree of hypospadias might not be quite common. The reason that so few are reported is that families look upon it as a kind of disgrace and it is carefully guarded.

FOUR CASES OF ANEURYSM OF THE THIGH SUCCESSFULLY OPERATED ON BY THE MATAS METHOD

By Gaston Torrance, M.D.
Birmingham, Ala.

Two of the following cases are of rather more interest than the others: one, because of its size, involving the whole middle third of the femoral artery; the other, because the man had only one leg.

Case I.—A colored miner, aged thirty-five years, noticed a mass in the popliteal space several months before admission to the hospital. One leg had been amputated through the thigh several years before as a result of an accident in the mines. He sought hospital treatment on account of pain from the tension of the growth. A pulsating mass, the size of an English walnut, was found in the popliteal space. Under ether, with a tourniquet snugly applied, the tumor was laid open and the openings at the upper and lower ends of the cavity were closed with No. 1 chromic catgut. As we had only one leg to deal with, great care was taken in closing the wound not to interfere with the collateral circulation that might be in the sac walls or in close proximity to it. The wound healed by primary union.

Case II.—A colored miner, aged forty years, was referred to me for operation for a pulsating mass in the popliteal space. He had noticed a growth about two or three months

before, but had not sought treatment until it became so painful that he was unable to work in the mines. Under ether the mass was laid open and two openings were found; these were closed with catgut and the cavity obliterated as in the above case. He made a good recovery and has gone back to work as a coal-digger.

Case III.—A white man, aged twenty-nine years, had his left thigh crushed in the mines in June, 1918, but no bones were broken. The bruises were chiefly in the middle of the thigh on the inner side. A small pulsating tumor appeared two or three weeks later. He walked on the leg for about a month, when the mass began to enlarge very rapidly. He was admitted to the hospital on September 26, 1918, with a large mass on the inner side of the left thigh, which occupied about the middle third of the thigh over the course of the femoral artery. The growth had pulsated up to a few days before he came to the hospital. Under ether a tourniquet was applied and the tumor laid open throughout; some blood clots were turned out and the openings at each end, which were about five inches apart, were closed with chromic catgut. When the tourniquet was removed there was very little oozing. The sac was infolded and loosely sutured up with a small rubber drain down to the cavity. The circulation in the limb was fairly good at the end of the operation and in a few days was practically normal. He made a good recovery and has a perfectly normal limb now.

Case IV.—A young man was referred to me January 7, 1917, with the history of an accidental stab wound of the lower inner side of the thigh just below Hunter's canal. There had been some bleeding and some clots had been removed by slightly enlarging the skin wound. When I saw him the circulation in the thigh was good and the limb was only slightly enlarged. We decided that there was

an injury of some muscular branches with bleeding into the tissues, and put him to bed with the foot elevated. He improved and was asking to be sent home, when on January 24 he began to suffer violently, and the leg became considerably swollen at this point. The following day, with a tourniquet around the upper part of his thigh, a long incision was made along the course of the sartorius muscle, which was dissected up; the heavy fascia beneath was very tense, and on being incised a false aneurysm was found, about four inches long, with a wound in the artery about a half-inch long. The wound in the artery was closed with six interrupted stitches of No. 1 chromic catgut. When the tourniquet was removed there was no bleeding. The sartorius muscle was sutured down over the arterial suture line and the cavity obliterated with catgut. A tube drain was placed in the upper end of the wound and the rest of it was closed. The circulation was normal from the time of the operation. He was kept in bed two weeks, when he was allowed to go home on crutches. At the end of five months he was reported to be perfectly well and hard at work on his father's farm.

DISCUSSION

Dr. Urban Maes, New Orleans, La.—I think Dr. Torrance's results are excellent, but we must remember that he has dealt with 4 cases of traumatic aneurysm in young adults, if I gather correctly from his paper. This type of patient, as a rule, has given ideal results with the Matas operation for aneurysm, for the simple reason it is the simplest of all operations and interferes less with the collateral circulation than any other type of operation before devised. The trouble has not come in the traumatic aneurysms of the extremities.

The cases that have given me the most worry are those better classified as pathologic aneurysms, which are due to disease of the bloodvessel wall.

Since the advent of salvarsan and the more active and intensive treatment of syphilis, we are seeing fewer of this type of cases. I would sound a note of warning that we had better stick to the principles as advocated by Dr. Matas in working strictly within the sac, interfering with the peripheral circulation as little as possible, and do what he is recommending at the present time, *i. e.*, to test in all cases the collateral circulation before attempting to obliterate the artery. The test is a simple procedure patterned after the Moschcowitz test to determine the efficiency of the peripheral circulation in gangrene. It consists of a constrictor or compressor put on the parent trunk and a tourniquet to exsanguinate the limb, leaving it on for ten minutes. The spiral bandage is then removed and the returning pink color is watched. The rapidity of return determines the efficiency of the collateral circulation. If the latter in ten minutes goes to the toes or fingers, as the case may be, it is safe to do the Matas operation or endosaccular suture.

Dr. Herman B. Gessner, New Orleans, La.—One of Dr. Torrance's cases interested me particularly, because it reminded me of one in which I secured a good clinical result but not a good technical result. It was a case in which the superficial femoral was pierced by a bullet, with a hole on each side. I sutured both sides, the parts healed and the patient recovered; but there was no pulsation beyond, so it was evident the preservation of his limb was due to the fact that he had good collateral circulation.

I noticed Dr. Torrance did not mention whether or not the circulation was present in the vessels beyond the site of operation when the patient recovered. It may be that the suture of the single orifice in his patient's artery was followed by occlusion of the vessel, and the preservation of the limb was due to the good collateral circulation.

There is one point that ought to be brought out, and that is the diagnosis of aneurysm. It happens occasionally that the mistake is made of plunging a knife into an aneurysm. That happened within a few years of the present time at the Charity Hospital, New Orleans, and was done by a young practitioner who should have known better, because of our own special interest in aneurysm.

I would stress in relation to diagnosis the value of the dis-

appearance of pulsation beyond the suspected mass. In 1918, when the military surgeons were taking a course in New Orleans, Dr. Matas operated before them on a man with a popliteal tumor. Inspection, palpation and ausculation were negative, but when I looked for his dorsalis pedis and posterior tibial, pulsation was absent in both. I made a diagnosis of aneurysm from the fact that there was a tumor along the line of the artery with complete disappearance of pulsation beyond. This diagnosis was confirmed by Dr. Matas at operation.

I have now in my ward a similar case awaiting operation. It is a good thing to suspect aneurysm when we find a mass in the course of a large vessel with the absence of pulsation beyond. (Here Dr. Gessner went to the blackboard and demonstrated the Matas operation.)

My experience with the Matas operation comprises 8 cases, in all of which the results have been uniformly satisfactory. There was no bleeding, either intermediate or secondary, and no gangrene.

THE PATENCY OF THE FALLOPIAN TUBES ASCERTAINED BY TRANSUTERINE INJECTION OF FLUIDS

By I. S. Stone, M.D.
Washington, D. C.

(Read by Title)

Since the introduction of air or gas into the peritoneal cavity by way of the Fallopian tubes has become a popular method, following the suggestion and practice of Rubin, of New York, it may be of interest to know that tubal irrigation through the uterus has been practised by the writer and some of his colleagues and assistants since its first use in 1896. The only allusion to the method which has been published by the writer may be found in the *Transactions of the American Gynecological Society* for 1909, in a discussion of papers by Dr. Boldt and Prof. Hoffmeier on "Conservation of the Pelvic Organs."

The method was first tried during the operation upon a young woman with acute bilateral salpingitis and appendicitis with extensive pelvic peritonitis. We were impelled to pursue a conservative course in this instance because the patient was expecting marriage in the near future. At that time it was considered folly to leave a tube which was "dripping with pus," yet we allowed the left tube and corresponding ovary to remain *in situ,* although the specific nature of the infection was beyond question (the responsible party confessed it). After opening the abdomen and remov-

ing the right tube and ovary with the appendix, all of which were hopelessly destroyed, we proceeded with the injection. The cervix uteri was caught with a tenaculum forceps, a large glass syringe filled with hot mercuric bichloride, 1 to 1000, was introduced into it and passed through the internal os. Firm pressure with the hand caused a small stream of the solution to appear at the pavilion, which was caught upon a sponge and not allowed to flow into the abdomen. Besides the transuterine irrigation of the left tube, the same solution was used to irrigate its distal end by distention and flushing until we reached every possible fold in its mucosa. After a stormy first night the patient recovered, was married and bore her first child nine years afterward and a second child two years after that. The patient and her two daughters are now living and in excellent health.

Since then tubal injections have been practised at Columbia Hospital in this city, especially since iodine had come into use as a sterilizing agent. In some instances the injection has been made just before opening the abdomen in an effort to secure a better technic, but, as a rule, the incision is made first. Inhibiting solutions have, as a rule, been used, and we are not informed if the full strength of tincture of iodine has been used in any case. We are not aware of any accident as a result of this procedure nor have patients suffered additional pain. There is always a rise of temperature after "pus operations," and we cannot decide that it is ever caused by these injections. We have not heard of a single instance of accident or even anxiety due to these injections since iodine has been used.

In a few instances we have tested the patency of the tubes in cases of sterility. In our last case the patient had been married for six years without conceiving. During the greater part of this time she had an uncontrollable leucorrhea. When she came under my care the discharge persisted after resorting to the customary treatment, includ-

ing curettement. The husband was found competent in every particular and in absolutely perfect health. The use of bismuth injections appeared to benefit the patient, but we determined to investigate the condition of the tubes, as the patient was very anxious to have a child and willingly consented to have her abdomen opened. It is possible that the isthmus was the seat of the obstruction or infection in this case, for the patient conceived three months after leaving the hospital and her child is now two years old. In some instances we have failed to succeed in passing some obstruction in the tube, the force being hand-pressure, as mentioned above. The cornua and the narrow portion of the tube, including the isthmus, have hitherto been con-considered beyond reach of our usual methods. Is it not a fair supposition that some method of reaching this area would enable us to deal with the infection or obstruction which has left a patient hopelessly sterile? Attempts at teaching the remote cornua and isthmus by curette or probe have failed, while it remains to be determined if distention of the tubes with gas will prove to be successful in relieving sterility.

There is no ground whatever for fear of forcing infectious tubal contents into the peritoneal cavity when fluids are used as described above. In any case with pus in the tubes the peritoneum is either infected or shut off by protective adhesions, while by our method the tubes are held in view upon a sponge outside of the cavity before the irrigation begins.

A word of comparison between the efficiency of the two tests for patency remains to be said. The visible evidence of patency determined in appropriate cases with the abdomen open is gratifying and definite. To this it is quite possible that a measure of or even complete sterilization of the mucosa of the isthmus has been added, while with gas we could not hope for such a result. Again, we know that the introduction of gas into the cavity will only prove one tube

to be open, and we still would be uninformed as to the condition of the fimbriæ, which may be sufficiently open for the passage of gas under pressure and yet be incapable of performing their function. We are confident, however, that the proof of the actual presence of tubal obstruction by the recent use of air or gas will prove an illuminating aid to the study of sterility, a subject which has hitherto not received the attention to which it is entitled, as we can observe very little if any better results of treatment by modern than by former antiquated methods.

NOTE.—It is quite possible that tubal injections given without opening the abdomen may return to professional favor. If so, let no one think himself a pioneer who tries it, for the literature of German medicine contains a report of an operation of this kind written half a century ago.

ACCIDENTAL URETERAL INJURIES DURING PELVIC OPERATIONS: REPORT OF CASE

By John M. Maury, M.D.
Memphis, Tenn.

On November 3, 1921, E. R., a colored woman, was admitted to the wards of the Memphis General Hospital. She had been married five years, with no pregnancies. She entered the hospital because of a mass in the abdomen which had grown rather rapidly in the last few months. Menstruation was regular, every twenty-eight to thirty days, lasting four days, and the last menstrual period had occurred two weeks previously. The temperature and pulse were normal. The urine showed an occasional pus cell and an occasional granular cast, but no albumin. There were 9400 white cells, with 70 per cent polynuclears and 18 per cent lymphocytes. The blood Wassermann was negative. Physical examination was negative except for the presence of a smooth, solid tumor filling the lower abdomen and reaching within two inches of the ensiform. Pelvic examination showed the cervix high up posteriorily and the tumor almost filling the pelvis. The diagnosis was myofibroma growing from the anterior wall of the uterus.

Operation, November 8. Realizing that the tumor in its growth had probably brought the bladder above its normal position, the abdomen was entered just below the umbilicus and the wound enlarged both upward and downward. On delivering the tumor the bladder was at once

seen to be spread out on its anterior surface, reaching upward to the umbilicus and well out on both sides. Its walls were quite thin and so adherent to the fibroid that on stripping it down, a rent two and a half inches long was torn in its summit. The uterus and broad ligaments were low in the pelvis and could not be reached until the last steps in the removal, but by rotating the tumor backward the cervix could be reached and the tumor removed from below upward.

Being fully aware of the fact that the ureters must lie in an abnormal position, every care was taken to prevent injury to them, and only blunt dissection was employed until it was thought that they must be safe. Nevertheless, they were both cut in the last stages of the operation, but at such a point that implantation into the bladder could be made without tension. Two lateral flaps were made at the end of each ureter by a longitudinal incision three-eighths of an inch long, dividing the anterior and posterior walls. After drawing the ureters through an oblique puncture in the bladder wall, these flaps were bent outward and stitched to the mucosa with a single fine catgut suture. A single fine silk suture on the outside going through the muscularis and the periureteral structures served to fasten the bladder snugly around the ureter and prevent its being pulled out. The tear in the bladder made the implantation particularly easy. The bladder wound was closed and the operation completed in the usual manner. A urethral catheter was kept in for ten days.

Her convalescence was unusually smooth. The urine, which at first was bloody, soon cleared up and a cystoscopic examination before she left the hospital showed urine discharging from both ureters. No attempt was made to catheterize the ureters at that time, but she was passing about forty-five ounces a day, specific gravity 1016, acid and normal, except for a faint trace of albumin and an occasional pus cell.

Three months later another cystoscopic examination was made by Dr. Cullings and the following report returned:

A cystoscope was introduced into the bladder without difficulty. The bladder mucosa was apparently normal, except for several small areas at the base showing slight congestion and a few small bits of pus membrane adherent to these areas. The natural ureteral openings were normal in appearance, except for a rather "ironed out" appearance. The catheter was introduced into both right and left and passed up each about one inch. Both openings still show intermittent contractions. Artificial ureteral openings appear above on the posterior bladder wall about one and a half inches from the original opening and are separated by a distance of about two inches; each is marked by a small pedunculated body about the size of a B. B. shot. Right opening is situated just above the pedunculated body marking its location, and is quite large. The left opening is located on the lower surface of the pedunculated body of that side and is very small—in fact so small that close inspection is necessary to identify it. There is an intermittent pulling in of both ureteral openings, not unlike that of the normal, but no swirl of urine can be detected from either.

The catheter passes up to the right pelvis with ease. Urine discharged at normal rate at first, but soon slowed down to an occasional drop. At first, discharge was intermittent as in the normal. Catheter could only be passed into the left ureter to a distance of one-half inch, where obstruction was met. Very small catheters and also very stiff ones were used in an effort to get by the obstruction, but at no time could any of them be passed far enough to include the catheter eye.

Phenolsulphonephthalein, 1 cc, injected intravenously, and appeared in the urine of the right kidney in twenty-three minutes (I feel rather sure that this is not entirely accurate, as the discharge of urine through the catheter was

not normal at that time, having slowed down considerably). The phthalein output in two hours was 54 per cent.

After injecting the right pelvis with 25 per cent sodium bromide solution a pyelogram was made by Dr. Conly, who reported: "The pelvis appears large, but in relation to the size of the calices, it is regarded as normal. The ureter does not appear at all dilated." Blood examination showed urea nitrogen to be 35.28 and creatinin 2.36 mg. per 100 cc.

Although during the operation every effort was made to prevent injury to the structures and the immediate result was perfect, as shown by the cystoscopic examination two weeks after operation, the final result was a complete blocking of the left ureter, probably from cicatricial contraction one-half inch above the anastomosis, and impaired function of the remaining kidney, as shown by the moderate retention of urea nitrogen and creatinin in the blood, though the elimination of phenolphthalein was normal.

Accidental injury may occur to one or both ureters and may be inflicted with ligature, clamp or scissors.

Ligation. Events developing subsequent to ligation depend upon whether one or both ureters are ligated and the length of time elapsing before remedial measures are instituted. Unilateral ligation done accidentally, provided the other kidney is sound, usually passes unnoticed. The other kidney silently takes upon itself the function of both or, at most, there is no more evidence clinically than tachycardia with pain and tenderness over the loin of the affected side. (Robinson[1].) Judd,[2] Frankenstein[3] and others have taken advantage of this fact to deliberately ligate and drop one ureter in operating upon cancer of the bladder involving one ureteral orifice when it was found inexpedient to implant the resected ureter into the bladder. In rare instances, anuria has resulted in reflex suppression after ligation of one ureter, as in a case mentioned by Robinson,[1]

in which decapsulation of the sound kidney restored function. If infection already exists, it will nearly always be necessary to remove the kidney. The results of ligation are manifest in the kidney, the ureter above the seat of ligature and in the ureter at the point of application of the ligature.

Animal experimentation has shown that dilatation of the ureter and pelvis of the kidney begins at once after ligation, with progressive impairment of kidney function, until at the end of four or five weeks the kidney is functionless. Up to a certain point in the progressive damage which is taking place in the kidney, release of back pressure by nephrostomy or deligation may result in restoration of function to normal. The time within which restoration to normal may occur is set by Johnson,[4] from animal experiments, at two weeks from the time of ligation. It is probable that this is at least approximately true in man, for in a case reported by Caulk and Fischer,[5] in which both ureters were ligated, double nephrostomy on the eighth day was followed by complete restoration of function, and there are other cases reported of return to normal function after a shorter period of occlusion.

The damage done locally by the ligature may vary in degree from slight traumatism, quickly repaired, to complete occlusion by cicatricial formation at the point of injury. The amount of damage seems to be directly proportionate to the length of time the ligature remains in place. In animal experimentation where the ureter is isolated and tied, greater damage results than after accidental ligation during operations, where more or less of surrounding tissues are included in the ligature. This is proven clinically by numbers of reported cases in which prompt loosening of the ligature has resulted in immediate and permanent restoration of ureteral function.

Kolb[6] removed a ligature, accidentally applied, after twenty-four hours and at autopsy shortly after there was

no evidence of necrosis at the point of ligature. Kroemer[7] reports two cases in which immediate loosening of the ligatures gave permanent relief.

Even complete cicatrical occlusion may not be permanent. In the article by Caulk and Fischer, above alluded to, the process of canalization after cicatricial occlusion following ligation in animals is beautifully illustrated, showing complete repair in six weeks; and in their case in which double nephrostomy was done on the eighth day after bilateral ligation, repair of the ureters was complete with passage of urine by the bladder on the fifty-eighth day.

Clamping. Judging from what may be found in the literature, injury from clamping is a rather rare incident, but as one would suppose, results in greater damage over a larger area. The injury resulting is either a necrosis with fistula formation or a more or less complete stricture, depending upon how long the clamps remain on.

Furness[8] mentions a case in which clamps were accidentally applied to both ureters, and though they remained on only seven or eight minutes both ureters sloughed, fistulæ forming on the eighth and twentieth days.

In a personal experience the left ureter was accidentally clamped, but immediately released. Had I then been aware of the result in Furness's case, I would at least have considered the advisability of doing a resection with anastomosis. Nothing was done, however, and the patient made a good clinical recovery, though it is possible and even probable that stricture formation resulted.

Severance. Injury by the scissors means either a simple severance of the organ or the removal of a segment. Fortunately, this injury is usually detected at once. Either there is an escape of urine which tells the tale or the severance of a tubular structure of such size arouses suspicion which leads to an examination and detection of the injury. If not detected, there results the usual signs and symptoms of urinary infiltration.

Treatment. The knowledge of accidental injury by ligation implies that both ureters have been tied. This, of course, means that the condition must be remedied or the death of the patient will result. The remedial measures which may be employed are five:

1. Removal of the ligatures.
2. Implantation of at least one ureter into the bladder.
3. Ureteroureteral anastomosis on one or both sides.
4. Nephrostomy.
5. Severing one or both ureters and bringing the proximal ends to the skin surface.

In considering what remedial measures to employ, it must be kept in mind that the patient, in the near past, has already been subjected to a major operation, and usually a serious one, because it is in the bad cases that the accident occurs. Removal of the ligatures is the procedure of choice, and when done early there is good reason to expect a satisfactory result. It is more easily accomplished when undertaken before the organization of wound exudates has obscured the field. If for any reason there is delay, the least that one may expect is more or less complete stricture formation with incidental damage to the kidney, and simple deligation will not suffice. In order of choice, ureterovesical implantation, ureteroureteral anastomosis or nephrostomy may be employed. In the event of the patient's condition precluding the possibility of choice, the least time consuming procedure must be followed, and this is nephrostomy. Double nephrostomy may be done in a few minutes with the expectation that absorption of the ligature and canalization will result in due course of time, while the condition of the patient may make an anastomosis a formidable procedure. If canalization is not satisfactorily accomplished the patient is in good condition for anastomosis or implantation. Severing the ureter and bringing the proximal end to the surface has been employed, but one can hardly imagine

conditions under which one of the other methods would not serve a better purpose.

Injury from clamping, when it is necessary to do anything, means that the injured area must be resected, and the problem of repair is then the same as when the ureter is accidentally severed. Whether simple ligation above and below the seat of injury, ureteroureteral anastomosis or a vesical implantation shall be done will depend upon the choice of the operator, the location of the injury and the condition of the patient.

As pointed out by Reuben Peterson,[9] in a valuable contribution to this society in 1920, the invagination and the end-in-side methods give the best results of the various methods of anastomosis.

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SARCOMA OR EMBRYOMA OF THE KIDNEY IN INFANTS

By Charles R. Robins, M.D.
Richmond, Va.

The type of tumor referred to in this paper is that of the rapidly growing tumor of the kidney found in infants and very young children, and evidently of embryonic origin. These tumors have always been of interest and have been the subject of considerable study and investigation. Clinically, they have commonly been referred to as sarcoma of the kidney in infants, but histologically they have been described by a number of names, depending on the histological elements found.

The first attempt to separate these embryonal tumors into a class by themselves and differentiating them from other kinds of growths was made by Birch-Hirschfeld in 1894, and since then they have been studied and reported by various observers, who have also advanced theories as to their origin. A unanimous opinion on this point has apparently not yet been reached. They are, however, always embryonal in origin and are the result of inclusion. The confusion in the nomenclature has been due not only to the variety of tissues found, but to the findings of both epithelial and mesoblastic elements. The most interesting structures are the rudimentary tubules and glomeruli. The tubules are often quite definitely formed and show a lumen lined with cuboidal cells and with a basement membrane.

The most frequent tissue found and the most predominating is the proliferating connective tissue which usually forms the stroma of the tumor and in which the other structures are situated. In addition to these characteristic constituents, there may be found striped and smooth muscle fiber, cartilage, fat, bone, collections of epithelium and a rudimentary substance from the nervous system.

However, all of these tumors, whatever may be the predominating tissue, are evidently of the same origin, present the same history and characteristics, and contain both epithelial and mesoblatic elements. They are therefore referred to as "mixed tumors." In those cases where one element only is reported the examination is doubtless incomplete. These tumors are usually rapid in growth and reach a very large size, often completely filling the abdomen of the infant before they are brought to the surgeon. They are usually smooth and globular in shape and the average size at the time of removal is that of a grape-fruit. They usually occur in the substance of the kidney and the growth is expansive, displacing the normal kidney structure, but not infiltrating it. The kidney tissue that is pressed upon atrophies, but the balance of the kidney retains its normal shape, appearance and function, and usually presents itself as a "nubbin" projecting from the periphery of the tumor. The tumor apparently presents a very definite capsule which, however, is adventitious. Metastases are relatively infrequent and the lymphatics are almost never involved.

Notwithstanding this, these tumors have been found to be intensely malignant, with a high rate of primary mortality from operation and a high rate of recurrence, so that a total mortality rate, including that of operation and recurrence, has been reported as high as 93+ per cent. However, recently, Loughnane, quoted by Mixter, reports on 13 personal nephrectomies, in which there was 1 death from operation only and the late results were: Results unknown,

3 cases; survived three years or more, 4 cases; alive and healthy two and a half years after operation, 2 cases; died from intercurrence of phthisis within three months, 1 case. This is the most favorable group of results that I have been able to collect, and is, I think, unusual. It may be that the cases were detected and operated at a very early period or the cases may have been selected for operation. Other reporters, however, who have had cases to survive, have found that this took place in advanced cases. In the cases reported by Mixter there was an operative mortality of 35 per cent in 14 nephrectomies and 9 survivals, and of these all showed rapid recurrence and death except one, who was alive and well three and a half years following nephrectomy.

The symptomatology is quite different from that of malignant disease of the kidney in adult life. Hemorrhage is quite infrequent and urinary findings are negligible. This is quite easily understood when the tumor is examined. It is a tumor in the kidney and not of the kidney, and that portion of the kidney that is not affected by pressure is perfectly normal. The patient is usually somewhat anemic looking, usually suffers to some extent from digestive disturbance, but there are no characteristic or pathognomonic symptoms, and the diagnosis of the case is involved in the finding of the tumor. This is usually quite accidentally discovered by the parent. The tendency for children to have enlarged abdomen in various conditions, as a rule, prevents the parent from suspecting a serious condition and the absence of symptomatology does not suggest the calling in of a physician until the disease is well advanced. The majority of these cases undoubtedly are discovered in children's hospitals, where routine examinations are made of all cases. As to the outlook in this condition, it would appear that better results may be secured. If the family physician and pediatrician are on the outlook for

them, they will doubtless be discovered when the tumor is still small and before the general health of the patient has been affected.

Radiation has accomplished so much in other conditions that it should be of great value in this. The complete removal of the tumor in favorable cases, with subsequent radiation, should give better ultimate results. The diagnosis depends on finding the tumor, which is usually of firm consistency, globular and of regular outline, with a certain amount of mobility in operable cases, and which can be traced to the kidney region. Should doubt exist as to the nature of the tumor, ureteral catheterization and a pyelogram will be of great value.

My own experience is limited to 4 cases, only 1 of which I will report. This case is of interest because the specimen gives a very typical example of the tumor and because the patient is still alive and in robust health after the operation.

History of Case. Register Number, 26–7. R. M. S., male, aged one year. The patient was sent to me on January 4, 1921, by his physician, on account of a lump in the right side of the abdomen. His mother stated that his abdomen had always looked full, but she had not noticed any lump in it until three days ago, when it was noticed when the baby was on its father's lap. The baby does not seem to suffer a particle. Has always been hearty. Bowels have kept open, but he has looked rather delicate. He had been suffering from a suppurating middle ear, but his mother said that he appeared to be picking up some, and she had not noticed any loss of weight. She had not noticed anything abnormal about his urine.

On examination the patient was found to be rather pale looking, with prominent veins. The abdomen was distended, and in the right side of the abdomen a globular tumor was found nearly filling the entire abdomen. It could be palpated posteriorly in the right kidney space and flank and

Fig. 1.—General appearance of tumor growing in lower pole of kidney with a perfectly normal upper pole.

Fig. 2.—Specimen split open. Upper pole and pelvis normal. Apparent capsule made of displaced and thinned kidney substance and kidney capsule.

Fig. 3.—Photograph of patient, October 23, 1922, twenty-one months and seventeen days after operation. No evidence of any recurrence. Still in excellent condition two years after operation.

seemed to be somewhat attached at this point, although freely movable. The pelvis and subcostal region appeared to be clear and the tumor projected anteriorly. A diagnosis of sarcoma of the kidney was made and operation advised, which was done two days later.

The incision was made in the semilunar line, and on opening the abdomen the ascending colon and small intestine were found displaced to the left by the growth of the tumor. The peritoneum was incised external to the ascending colon and the kidney removed from its bed without difficulty. The pedicle was isolated and the vessels and ureter ligated separately. At the lower pole of the kidney an aberrant artery and vein were found to enter. These were ligated separately. There was comparatively little bleeding, and this was easily controlled; the peritoneum was sutured and the abdominal wound closed without drainage.

The tumor was about the size of a grape-fruit and sprang from the lower pole of the kidney, the upper portion of the kidney being quite normal. A number of vessels radiated from the hylum to the periphery of the tumor. The patient stood the operation very well and was only slightly shocked. Following the operation his temperature went up gradually until it reached 102°, where it remained until the eighth day following the operation, when it dropped suddenly. In the meantime he had developed a discharge in his left ear, which had previously been infected. This apparently accounted for the temperature entirely. He was discharged from the hospital two weeks after the operation, apparently in excellent condition, and three months after the operation his mother wrote me that "the baby is doing lovely. He had some trouble with his ear for a while, but made a complete recovery. He sleeps fine, is real fat and crawls any and everywhere." In October of this year she wrote me that he had double pneumonia in the spring and had been very ill, but had recovered from that. A week later she brought him to my office, where I made an examination,

and found him in excellent health, his wound nicely healed and no evidence of any tumor or swelling.

The following is the report on the tumor, made by Dr. Ward H. Cook, professor of pathology in the Medical College of Virginia:

"S., 22–546. Specimen received in Kaiserling's fluid No. 1, in which it has been preserved since January 6, 1921. The specimen consists of an ovoid tumor 11 x 9 x 7.5 cm., which occupies the lower pole of a small lobulated (infantile) kidney. Excepting, perhaps, in the thinned lower tip of the organ, the tumor is definitely encapsulated by fibrous tissue which is continuous with the capsule of the kidney. The tumor tissue is softer than the kidney substance, is faintly lobular but otherwise homogeneous in the upper portion, marked by a wedge-shaped fibrous septum mesially, soft and friable laterally, and contains large, rounded masses of soft, thready consistence in the lower third.

"*Miscroscopic.* Sections are examined from every portion distinctive in gross appearance. These show a lobular tumor, the lobules of which vary greatly in size and form. The larger lobules consist of short, closely set, spindle-shaped cells indistinctly separated into small groups by vascular spaces of capillary structure and delicate, twisting strands of fibrous tissue. Occasionally within such groups there is perfect epithelial differentiation in the form of tubules of single-layered cuboidal cells and glomerular structures composed of vascularized plugs of fibrous tissue, somewhat lobulated, covered by low cuboidal cells and projecting into a dilated tubular structure. Other cell groups show epithelial differentiation less perfect both as regards convoluted tubules and glomeruli, yet definitely indicated.

"Other lobules consisting of small, rounded cells, with relatively large deeply staining nuclei, show a similar tendency. Some of the cells, having developed more cytoplasm, are to be seen in rosettes which occasionally are

found with a definite lumen, thus assuming an acinar structure. The epithelium-like cells which make up such acini are sometimes in two or even three rows.

"Still other areas of the tumor exhibit small, more widely separated lobules, each of which contains what appears to be a rudimentary structural unit of the renal cortex. The formation of glomeruli is a striking feature. Mitotic figures are of frequent occurrence throughout the tumor. Careful search fails to reveal either smooth or striated muscle fibers.

"The tumor is evidently derived from a portion of the anlage of the metanephros which has retained its embryonic character and growth activity. It is producing epithelial and connective-tissue elements and probably also endothelial structures."

Diagnosis: Mixed tumor of the kidney.

MECHANICAL AIDS IN THE DIAGNOSIS OF SURGICAL CONDITIONS OF THE URINARY TRACT

By W. E. Lower, M.D.
Cleveland, Ohio

The importance of a correct diagnosis, if it can be made, before initiating a surgical procedure must be apparent to everyone. The difficulty of making such a diagnosis, especially of diseases of the urinary tract, by the routine physical and urinary examination, is also well known. It is now generally recognized that in most cases the seat of a lesion of the urinary tract cannot be established by a urinalysis alone, even when a microscopical is added to the clinical examination. Like a compass, the urinalysis indicates direction but does not, as a rule, establish location. Because of this uncertainty other methods, mostly mechanical, have been devised to establish the seat of the lesion. The development of these methods has led to specialization, which in turn has brought the diagnosis of diseases of this system to as high a degree of accuracy as is the case with diseases of any other system of the body. *Pari passu* with this development, however, has come a narrowing of function both on the part of the general surgeon and the genito-urinary specialist until, like a wire which is drawn out to too fine a caliber, much of the real strength of each has been lost. In other words, the general surgeon is becoming so dependent upon the assistance of special

A. Arrangement for attachments for urine recording apparatus.

B. Roentgen-ray equipment.

Fig. 1.—Especially equipped cystoscopic table.

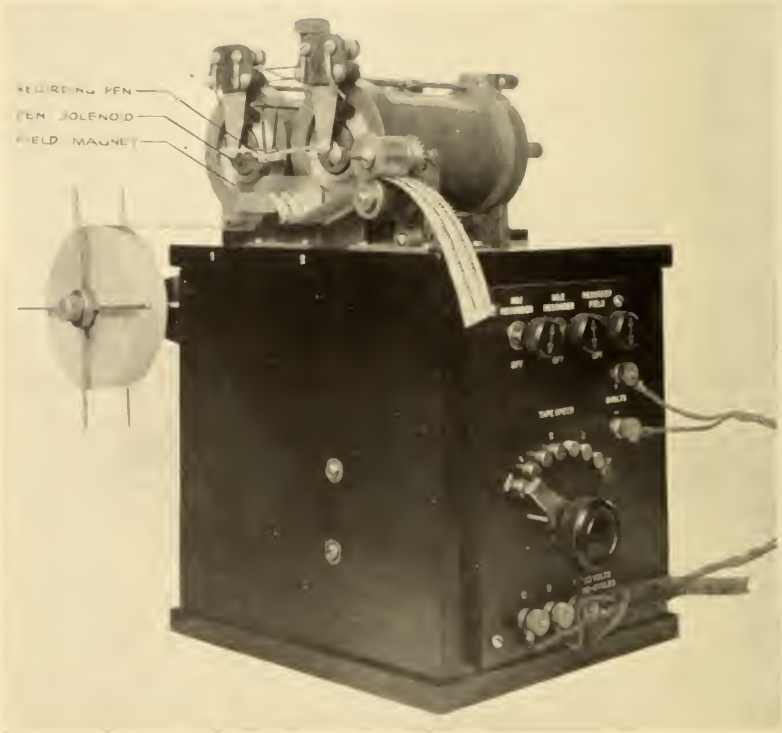

FIG. 2.—Urine recording apparatus.

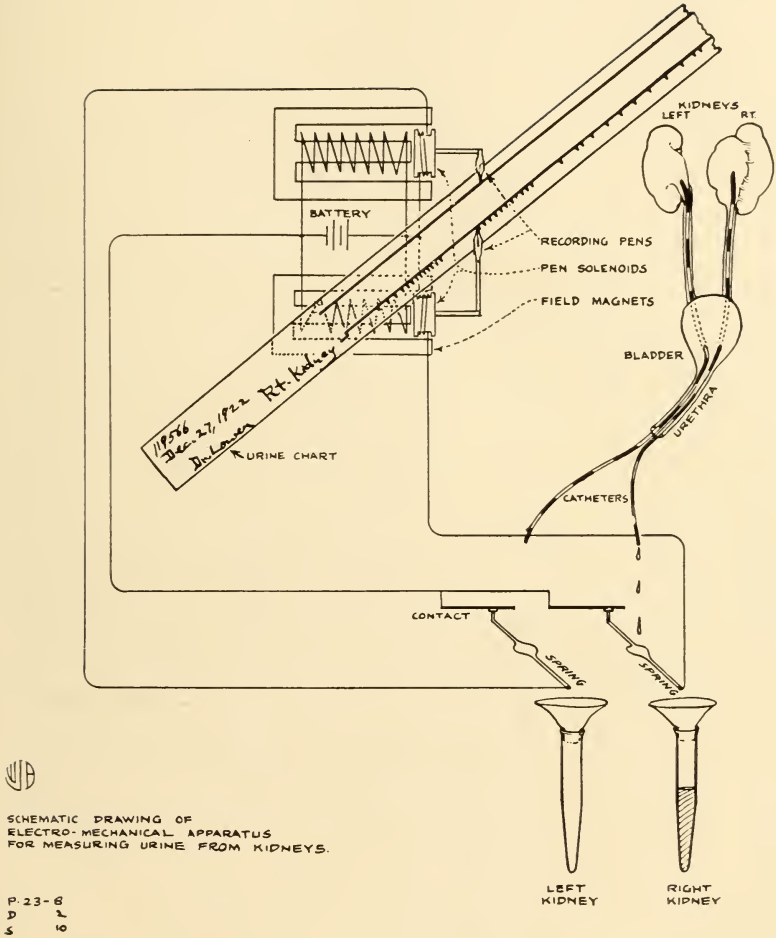

FIG. 3.—Urine recording apparatus, schematic drawing.

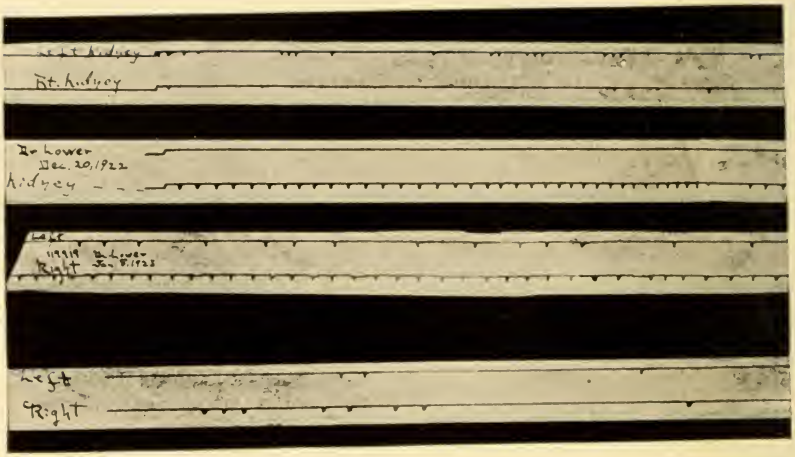

Fig. 4.—Urine excretion records made with apparatus shown in Figs. 2 and 3.

technicians in working out his diagnosis that he is losing his special perspective and becoming merely an operative technician. Even that might not be unfortunate if after the diagnosis were made he were called upon to operate; but in many parts of the country the men who make the diagnoses are also essaying the operations, with the result that many so-called urologists are attempting operations without any previous general surgical training whatsoever, and unless the general surgeon will show a greater interest in diagnostic work this practice will continue. I do not want to take away one bit of credit from the well-trained genito-urinary surgeons who blazed the way and who are competent in every way to do splendid surgery, but I do want to make a plea for a better general surgical training for those who wish to do surgical work in a specialized field.

The cystoscope and the ureteral catheter require no demonstration or illustration, nor does the technic of the roentgen-ray examination of the genito-urinary tract, a description of which is best left to the roentgenologist. I do wish, however, to emphasize the essential diagnostic value of the roentgen-ray findings when combined with physical examination, urinalysis and ureteral catheterization.

By having the equipment for taking the roentgenogram incorporated in the cystoscopic table, much time is saved and the patient is spared the annoyance and discomfort of a second preparation and catheterization. (Fig. 1, *B*.)

During recent years there has been an increasing tendency to apply the laws of physical chemistry to the interpretation of pathological conditions. If it shall finally be proven that normal and pathological processes can in their entirety be interpreted by the laws of physical chemistry, then it follows that physical chemical processes will become increasingly applicable to diagnosis. Since, according to physical chemical laws, every variation in function will presumably be accompanied by a variation in temperature, it would

follow that an apparatus which can detect minute variations in temperature might be of value in obscure cases in determining, for example, which of the kidneys is affected. For the detection of minute variations in temperature, physicists employ thermocouples. I therefore requested our department of bio-physics to construct for me thermocouples, the connecting wires of which could be passed through ureteral catheters. This was done, and these especially constructed thermocouples were used in two cases. In one case, in which a diagnosis of infected intermittent hydronephrosis due to calculus in the left ureter was made and verified at operation, the temperature within the left ureter was 0.041° C. higher than on the right side; in another case, in which there was an infected calculus in the left kidney, the temperature of the left kidney pelvis was 0.05° C. higher than on the right side.

Another application of the science of physics to the diagnostic problems in this field is shown by a device whereby simultaneous records of the excretion of urine from the two kidneys are made. (Figs. 2 to 4.) This apparatus, also, as well as the roentgen-ray equipment, can be connected with the cystoscopic table. (Fig. 1, *A*.)

These last two methods are described only as a preliminary note because they suggest what may prove to be methods of value in differential diagnosis.

It should be emphasized that these newer aids cannot replace urinalysis and the cystoscope; but the roentgenogram, the findings in the cystocopic examination and the urinalysis, the measurements by means of the thermocouple and the record of urine excretion are to be interpreted together with the anamnesis by the *clinical judgment* of the examining physician.

END-RESULTS IN MALIGNANT DISEASE OF THE TESTIS

By William B. Coley, M.D.
New York

In a previous article, 64 cases of malignant disease of the testis were reported. Since then there have come under observation 14 other cases, making a total of 78 cases. In this entire series the great majority of cases were observed in the later stage of the disease after recurrence had taken place and the condition had become practically hopeless as regards a permanent cure. Only 15 of the cases were seen during an operable stage, before there was any evidence of metastasis. Of these, the toxins were used as a prophylactic after operation in 10 cases. Five were treated by operation without prophylactic after-treatment of any kind; 1 of these was an embryonal carcinoma which has remained well four years after operation; 1 died of metastases within one year of castration; the other 3 cases have not been traced.

In the 10 cases in which the toxins were used alone, in 9 cases and combined with radium in 1 case, after operation, in the hope of preventing a recurrence, 9 are living from three to fourteen years after operation; 4 are alive ten to to fourteen years later. One of these cases, after remaining well for fourteen years, had a recurrence in the other testicle, which was removed by operation, and the diagnosis confirmed by microscopical examination. In addition to these cases

there are 3 other cases which were treated after a recurrence had taken place, but before abdominal metastases had occurred, which recovered under the toxins alone, and the patients have remained well from five to twelve years.

Barringer[1] reported 35 cases of sarcoma of the testicle, nearly all of which had been treated with radium alone, and a few cases with radium and roentgen ray. Of this series there was only 1 patient well over three years; a large, recurrent metastatic tumor of the abdomen, which entirely disappeared under treatment, and the patient was well at the time of last observation, three years and five months later. His report includes only 3 cases in which radium was used as a prophylactic measure after castration of a primary operable tumor of the testis, and of these cases, 1 remained well for nine months, 1 died and 1 was not traced.

In a larger number of cases abdominal recurrence had taken place which, under radium treatment alone, and in some cases under roentgen ray alone, showed marked regression. Barringer reported 1 case of remarkable regression and apparent cure: A large inoperable mass filling up the right pelvis, which disappeared under a single radium-pack application, and the patient remained well for three years and five months. In 1 case on my own service, a tumor, the size of a man's head practically entirely disappeared in the short period of two weeks under a single massive dose of radium; but about two months later the tumor recurred and again nearly disappeared under radium; however, each succeeding treatment had less and less effect, and the patient died within six months from the time of the treatment. These cases emphasize the fact that, in order to obtain a permanent cure in malignant disease of the testis, a proper form of treatment should be given at the time of the primary operation before visible or palpable metastasés have occurred, as there is little hope of obtaining a permanent cure after such metastases have developed.

Sarcoma of the testis occurs usually during the prime of life, and trauma has been noted as a probable causative factor in $33\frac{1}{3}$ per cent of our cases.

Age.	
20 months	1 case
Between 15 and 20 years	2 "
Between 20 and 30 years	20 cases
Between 30 and 40 years	32 "
Between 40 and 50 years	12 "
Between 50 and 60 years	3 "
	70 cases

The question of the pathology of malignant tumors of the testis has been exhaustively discussed by Ewing[2], who in a careful microscopical study of 19 cases of tumors of the testis reached the conclusion that all tumors of the testes had their origin in teratomas. Although there has been a gradual trend on the part of pathologists to accept in part the views of Ewing as regards the pathology of the majority of testicular tumors, few are willing to believe that all such tumors are of teratomatous origin. Chevassu in his study of 100 cases, classified only 1 as a teratoma, 47 as epithelioma, seminal, 50 as mixed tumors and the others as sarcoma.

One of the most important papers on the subject published since 1911, is that of Schultz and Eisendrath,[3] based on a review of the pathological diagnosis of microscopic sections of fourteen malignant tumors. They state that it is evident that there are still wide differences of opinion as to the origin and nature of tumors of the testicle, and that any histogenetic classification which attempts to include these diverse views must remain as complicated and unsatisfactory as most of the text-book classifications are today. Among the conclusions reached by these two authors are the following:

"For those tumors whose teratomatous origin is either definitely established by the presence of heterologous elements or is rendered very probable by the character of the atypical tissue the designation embryonal carcinoma should

be accepted. This term may be modified by the adjective hypoblastic, trophoblastic or epiblastic if the atypical tissue is glandular, syncytial or solid. Quite distinct from the embryonal carcinomas are the tumors of the solid, medullary, large cell type. The distinguishing characteristic of these tumors is the cell type. The tumor cell is morphologically identical with the younger cells of the spermatogenic cycle and is probably derived from the cells of the seminiferous tubules. For this kind of tumor the term spermatocytoma is suggested."

One has but to note the pathological reports on malignant tumors of the testis made at the various laboratories and the various reports published in the literature to become impressed with the great confusion that still exists in the classification of these tumors. For example, Bulkley,[4] in his report on 59 collected cases of tumor of the undescended testicle gives the diagnosis as sarcoma in one form or other in 40 cases, the remainder being teratoma, 2 epithelioma 2, chorioepithelioma, 2 carcinoma, 7 rhabdomyoma 1, and cancer 5. Sakaguchi,[5] in studying 32 cases of malignant tumor of the testicle, groups his cases as follows: Sarcoma 1, typical large cell tumors 21, atypical large-cell tumors 2, epithelial tumors 7, and 1 tumor with adenomatous areas and also solid cell nests.

Tanner[6] classifies the malignant tumors of the testicle into two main groups as follows: "(1) Carcinomatous; large-cell, large-nucleus type undoubtedly closely related to (2) mixed tumor type; (*a*) tumors containing cartilage, cysts, glands, etc. (*b*) ordinary glandular structure tumors; (*c*) chorioepithelioma."

In the present state of uncertainty as regards classification, we believe it is wise to group all cases of malignant disease of the testis under the general heading of cancer of the testis, as is done by Chevassu,[7] subdividing the different varieties, as far as our knowledge permits, into: (1) Teratoma, to include the mixed type of tumor, containing cartilage, cyst,

glands, etc.; (2) embryonal carcinoma, to include the pure solid tumor, that may or may not be of teratomatous origin, of the large-celled large nucleus type, (3) the rapidly diminishing group of pure sarcomata.

End-results Following Surgical Treatment. In a former paper[3] the opinions of various surgeons here and abroad as to the curability of malignant disease of the testis by operation was referred to at some length. Most of the authorities were uniformly pessimistic. There are no statistics, apparently, on which to base an opinion as to the end-results following the combined operation of removal of the testis and the retroperitoneal glands by abdominal operation, except those of Hinman[9] and Chevassu. The mortality of 11 per cent in 44 collected cases is sufficient to make one hesitate to adopt this operation until better end-results have been obtained. 41 per cent of these cases died at the end of one year. Hinman's statistics represent, probably, the most accurate estimate of the best end-results that can be expected of modern surgery alone. Of 24 cases traced of his series of 32, 20 had died and 4 were living. As regards the pathology of 18 cases in which the specimens were carefully examined, 9 were pronounced pure round-celled sarcoma and 9 teratoma. Of the 9 round-celled sarcomas, 2 are living, 1 twelve and 1 thirteen years; of the latter group (teratoma) only 1 patient is living, sixteen months. Of 7 patients treated elsewhere, only 1 was living twelve years later. It is interesting to note that of all of the patients who died, none lived for a period of two years; in other words, only 3 of this group lived longer than three years (about 10 per cent of the total number).

He brought out the very important point that although in only 2 per cent of the 44 cases were the glands palpable at the time of the operation, yet the abdominal operation revealed the fact that in 50 per cent of the cases the retroperitoneal glands were involved with the tumor. This would explain why the simple orchidectomy in the past has

cured so few cases. Another important fact brought out by Hinman is, that of 8 cases in which no glands could be found at the time of the abdominal operation 3 later died of cancer. Of the 44 cases collected, 20 were living at the time of his report, 9 over two years, an average duration of one year and eight months. The longest period of freedom from recurrence after operation was four years and ten months in 1 case.

While sufficient time has not elapsed to determine the number of permanent cures following radical operation, Hinman's statistics show beyond question that the prognosis can be materially improved by the abdominal operation; but this can only be obtained at the expense of a mortality of 11 per cent against a mortality of *nil* following the simple orchidectomy operation. In a second article, including 5 additional cases, Hinman[10] concludes that:

"1. The radical operation for teratoma testis is justified in suitable cases by the high mortality following simple castration; by the definite experimental and surgical demarcation of the primary lymph zone and by the possibility of the clean and complete removal of this zone.

"2. The radical operation is neither technically difficult, dangerous nor mutilating, as is proven by the fact that it has been successfully performed and the primary lymph zone completely removed in 5 cases of teratoma testis without a single troublesome operative or postoperative complication.

"3. These 5 surgical successes indicate that the mortality from this seemingly extensive operation should be little if any greater than that following castration. All 5 cases enjoy perfect health now nine months, seven and one-half months, four months, three months, two months and three years and six months, respectively, since operation.

"4. The ultimate result in these 5 cases cannot be known for years, but the finding in 4 cases of metastatic tumor tissue in the lymph areas radically removed demonstrates the usefulness of simple castration and the necessity of

radical surgery. A cure in any one of the 4 certainly, and possibly of the fifth, will have been directly due to the early and clean removal of the gland-bearing area."

Tanner,[11] basing his report on a study and analysis of 101 cases, classifies the tumors in 97 of the cases as malignant, 4 as benign, 35 as mixed or embryoid and 62 as of the soft-cellular, medullary type. He states: "Out of 600 cases collected, which were operated upon, 465 were followed. Of these, 377, or 81 per cent, were dead; while only 25, or 5½ per cent, were found to be living and well four years or more after operation." Of Tanner's series of 22 mixed tumors, only 2 were alive over three years; and of the 10 tumors found to contain cartilage, all but 1 case died. Of the 62 cases of carcinomatous type, 54 were traced, of which 25 had died; and 31 were living, 15 beyond four years or more after operation and 3 over ten years after operation. The statement in reference to my earlier paper[8] that in 52 cases of my own series the toxins were used after castration as a prophylactic is a serious error. That study was based upon a series of 64 cases, a complete tabulation of which was made at the end of the paper. He assumed that the toxins were used as a routine measure in all of these cases, when, as a matter of fact, they were used in only 9 cases as a prophylactic, and it was so stated in my previous paper.

In his series there were only 6 cases in which the toxins were used as a prophylactic after operation; 4 of these have died and 2 are living from seven to nine years after the operation. He adds that "these 2 were both of the so-called carcinomatous type of tumor, and about 33 per cent of them are cured by simple castration alone." This is hardly supported by Tanner's own statistics, *i. e.*, of 62 cases of the carcinomatous type, 31 were living at the time of the report, only 7 of which had remained well upward of seven years, which would make the percentage 11 instead of 33 treated by castration alone. He gives us, however, the first data on which we can base conclusions as to the pro-

phylactic value of radium or roentgen ray, singly or combined when given immediately after operation in operable cases. Stating that: "In this series 11 patients received roentgen-ray or radium treatments following castration. Roentgen rays alone were used in 7 cases, roentgen ray and radium in 3 cases and radium alone in 1 case. The results in the 7 cases treated by roentgen rays as given in the following table:

2 living and well four years after operation.
1 living and well three years after operation.
1 living and well two and a half years after operation.
1 died three months after operation.
2 died seven months after operation.

Total 7

"Cases treated by roentgen ray and radium:

1 living and well one year after operation.
1 died three months after operation.
1 died seven months after operation.

Total 3

"Cases treated by radium:

1 living and well six months after operation.

"From these statistics it is seen that 5 out of 11 patients are dead, and out of the 6 who are still alive only 1 patient is living over four years." Adding to the above the 3 cases which Barringer treated with radium as a prophylactic after operation, 1 well nine months, 1 dead and 1 not traced, we have 14 cases, of which only 1 remained well beyond the period of four years and 2 beyond three years. A comparison of these results with those obtained by the use of toxins as a prophylactic after operation would lead one to the conclusion that the latter agent was of greater prophylactic value.

In view of the fact that such a small proportion of cases

have been permanently cured by operation alone, it would seem difficult to explain the freedom from recurrence for such a long period in the present group on the ground of coincidence. It would seem more fair to conclude that the toxins have an inhibitory action on the growth of the tumor cells, in many cases sufficient to prevent their further development, and in other cases to postpone their activity for a long period of time. This conclusion is further strengthened by a number of cases in which recurrent tumors, whose malignant nature is unquestioned, have disappeared, and the patients have remained well for a considerable period, finally developing other recurrences which have proven fatal. In these cases the inhibitory action of the toxins is absolutely demonstrated, but for some unknown reason it has not remained sufficiently powerful to effect a permanent cure.

If we had no alternative we might be forced to admit that the radical operation should be the method of choice in malignant tumors of the testis; but, in our opinion, we have an alternative which should be seriously considered before resorting to such a serious procedure. Since the publication of Hinman's paper, radium has come into much more general use, and the methods of applying it have been greatly improved. So far we have no large series of cases in which radium has been used immediately after removal of the testis for malignant disease. In such a condition, immediate postoperative radium or roentgen-ray treatment, we believe, will give better results than orchidectomy alone. It was even hoped that by the use of large doses of radium we might be able to treat successfully the recurrent abdonimal cases; but Barringer's experience in nearly 50 cases of recurrent inoperable malignant tumors of the testis which have been treated by radium therapy has demonstrated otherwise. We have learned that by massive doses of radium administered in the form of a radium pack we could, in most cases, produce very marked regression of a large retroperi-

toneal tumor and in a considerable number of cases cause its complete disappearance. Yet in practically all of the cases, with one exception, the disappearance or improvement has proven only temporary. Therefore, as far as our present knowledge goes, we must admit that we are unable to offer much hope of a cure if the disease has metastasized in the abdomen sufficiently to produce large and palpable tumors.

The present series of cases show that even better end-results than those reported by the combined radical operation advocated by Hinman and Chevassu can be obtained by simple orchidectomy if the operation is immediately followed by prolonged systemic toxin treatment, with or without radium. We believe that the best results are likely to follow the combined use of massive doses of radium over the abdomen and left supraclavicular glands, and prolonged toxin treatment. Another point worthy of special emphasis is, that these results have been obtained without any mortality.

Method of toxin treatment: This should not be employed at all unless the patient is willing to have it kept up for a considerable period of time, at least six months. It can be carried out at home by the family physician and need not interfere with the patient's ordinary routine of living. The injections should be made deeply into the buttocks, beginning with a dose of ½ minim, diluted with a little freshly boiled water, and increased daily by ½ minim up to the point of producing a slight reaction, temperature of 99° to 101° or 102°. It should then be given only three times a week, increasing the dose only if necessary to the point of a moderate reaction. At the end of three months it is safe to diminish the frequency of the injections to two a week, using doses just large enough to produce slight reactions.

In all cases where it is possible, either radium or deep roentgen-ray therapy should be used in addition, covering the entire retroperitoneal glandular region on the side of the tumor. We believe it wise to repeat these treatments at

the end of four to six months. So essential is this that the introduction of the subsequent history of the appended case (originally reported in full in the Transactions of the Southern Surgical Association, 1917) will be most germane:

R. H., aged twenty months. Trauma a few months prior to the appearance of the tumor, which was first noticed in May, 1917, in the left testicle. This grew to the size of an orange in three weeks. The testicle was removed at this time by Dr. D. P. Murphy, of Elmira, N. Y. Three weeks later a recurrence took place, of very rapid growth, with involvement of the glands of the groin. A second operation was performed by Dr. Murphy about two months after the first one. This, also, was followed by a rapid recurrence of still more rapid growth. The patient was brought to me on October 19, 1917, and admitted to the Memorial Hospital. Physical examination at that time revealed a very large tumor, the size of two fists, extending down the thigh for a distance of six inches, the lower third of which was a fungating mass with foul smell and discharge. The tumor, which did not extend beyond the external ring above, was removed and the wound closed with skin from the other side of the scrotum. The patient was immediately put upon the mixed toxins of erysipelas and Bacillus prodigiosus (no other treatment).

Pathological report by Dr. James Ewing (December, 1917):

"The specimen is a round, solid, soft, elastic tumor mass, 7 × 8 cm.; it fungates through the skin over an area of 4 cm. wide, a portion of skin accompanying the specimen. On section the tumor is smooth, translucent, hemorrhagic along the fungating edge. It is circumscribed by an indistinct capsule. No portions of the testicle are visible in the single gross section. On miscroscopical examination the structure is composed of large and small groups of large polyhedral and spindle cells of indifferent embryonal type, consisting chiefly of hyperchromatic nuclei. These cell

groups grade off into an abundant mucinous tissue of myxomatous type and every gradation from polyhedral to star-shaped cells may be followed. Some cell clusters surround bloodvessels, which are not numerous. There are scanty small points of necrosis. The diagnosis is embryonal carcinoma of the testis, with transition to pseudosarcomatous structure." In reviewing the histology of the tumor in 1922, Dr. Ewing states that it is a true sarcoma and almost the only one he has ever seen.

The toxins were given for about two weeks and later continued at home by the family physician, to whom it was suggested that the treatment be kept up for a considerable period. At the end of a few months, however, the patient was so well that the treatment was discontinued. About a year and a half later, another nodule, the size of a pea, appeared in the neighborhood of the scar. This was removed and pronounced by Dr. Ewing to be of the same structure as the original tumor. The toxins were then resumed and kept up for an even longer period than before. At the present time, five years after the last operation, the patient is in excellent condition with no trace of a recurrence.

In this case, in view of the very rapid recurrence after two operations alone, I think it is only fair to assume that the toxins which were given after the third operation played an important part in the final recovery of the patient.

While a tabulated list of the case reports follows, a more detailed history of two recent cases may be of interest:

S. S. S., aged forty-two years, was operated on for sarcoma of the right testis by Dr. M. J. Seelig, of St. Louis, in 1902. A diagnosis of round-celled sarcoma was made at the University Laboratory and sections of the tumor were sent to Dr. Councilman, professor of pathology at the Harvard Medical School, who confirmed the diagnosis. The patient remained well until two or three years prior to 1919, when he had occasional attacks of cramps in the groin on the right side. It was

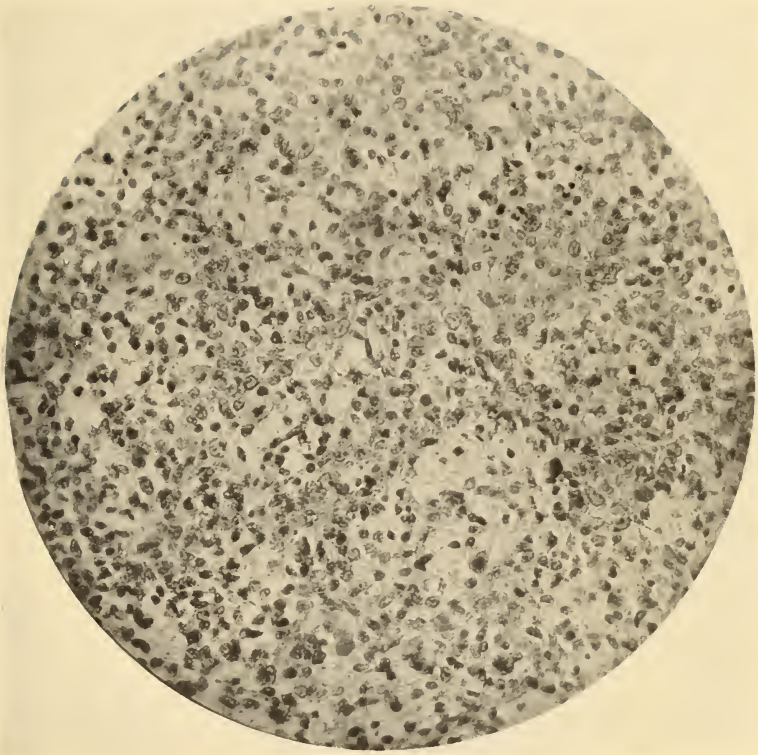

Fig. 1.—Three times recurrent, round and spindle-celled sarcoma of the testes, in a child twenty months old. Toxins given after last operation. Patient in good health over five years later. (Case XI in table.)

thought at first that the condition might be due to chronic appendicitis. He went to the Mayo Clinic in May, 1919, and the physical examination report at that time stated: "The large tumor in the abdomen is probably a recurring sarcoma involving the deep glands along the spine. This growth apparently is not attached to any organ. General condition is good." He was put upon roentgen-ray and radium treatment at the Mayo Clinic and under this the tumor subsided considerably. Shortly after returning home the tumor again began to increase in size, his abdominal symptoms recurred and another tumor developed in the left supraclavicular region. The patient was referred to me by Dr. Charles H. Mayo in July, 1919, for advice and treatment. Physical examination at this time showed a large tumor in the right lower abdomen, apparently retroperitoneal metastases from the primary tumor of the testicle. The left supraclavicular region was occupied by a tumor about the size of a hen's egg, apparently another metastatic growth from the primary sarcoma of the testis. The patient was admitted to the Memorial Hospital and treated with systemic toxins alone. After two weeks' treatment the mediastinal tumor had diminished to one-third its original size and the tumor in the abdomen had also decreased appreciably. He was then given a massive dose of radium over the left abdomen and the radium pack was placed on the left supraclavicular tumor. In about three weeks the supraclavicular tumor had entirely disappeared and the tumor in the abdomen had steadily decreased in size. The patient returned home, where the toxins were kept up for six months, at the end of which time he returned for further radium treatment. Examination then failed to reveal any tumor mass in the abdomen or supraclavicular region. Another radium treatment was given over the abdomen and the toxins were further continued. He has come on for observation every six months, during the first two years, and just once during

the last year. A careful examination in the fall of 1922 failed to reveal any visible or palpable evidence of any tumor either in the neck or in the abdomen. After remaining well for three and one-half years, in early January, 1921, he had what was supposed to be an attack of grippe, followed by a pleuritic effusion. He has had four aspirations of one-half to three and one-half quarts of fluid and chocolate-colored sterile fluid. No evidence of metastases of the lungs can be determined by roentgen-ray pictures or fluoroscopic examination. The patient remains in good health, June 5, 1923.

L. G., aged twenty-four years, was referred to me by Dr. M. Murray, of Hessle, East Yorks, England, on February 12, 1918.

Previous History: The patient served as an officer in the British Army since January, 1915. He was severely wounded in October, 1915, an artery being cut, for which the right leg was immediately amputated. In April, 1917, he was struck in the left testis by a tennis ball, following which there was severe pain, but no swelling, until August, 1917, or three months after the injury. The testis was removed on November 2 and the patient remained in the hospital for ten days. His general health was fair; he had lost some weight.

Pathological Report by M. Schofield, M. R. C. S., Pathologist to the Royal Free Hospital, London, December 17, 1917.

"Macroscopically the specimen consists of a large, firm, oval tumor measuring 4½ inches long and 3½ inches wide by 3 inches thick, distending the cavity of the tunica vaginalis and partly adherent to the latter. The cordis was attached to the upper and posterior part of the mass. The cut surface is firm and reddish brown in color, except for an irregular, yellow, friable portion in the center, evidently necrotic. Microscopical sections show a dense cellular growth com-

posed of large round cells, invading and entirely replacing the normal tissue of the testis. There is a marked chronic inflammatory reaction, especially at the spreading edge of the growth. In some parts the cells are very degenerate and the tissue completely necrosed, but in other parts many of the nuclei show mitotic figures, indicating rapid growth. The appearance is that of a large round-celled sarcoma. Sections through the cut end of the cord show no malignant cells."

Physical Examination: At the time of my first observation, February 12, 1918, showed a patient rather thin but not emaciated, with good color. Examination of the groin and abdomen showed no palpable evidence of metastases.

He was put upon the mixed toxins of erysipelas and Bacillus prodigiosus, beginning with a dose of $\frac{1}{3}$ minim and increasing up to the point of producing a marked reaction. The patient was very susceptible to the toxins, getting a temperature of 104° from 3 minims. He was never able to take over 3 to 4 minims during the entire course of treatment. In March, 1918, a massive dose of radium was applied at the Memorial Hospital, over the abdomen; 2 areas, 6207 mc. hours in each, at a distance of 6 cm. This produced intense nausea which lasted for several days. The toxins were continued with occasional intervals of rest. On September 17, 1918, a second application of radium was given over the same areas (upper and lower portion of the abdomen left), a total of 14,429 mc. hours at a distance of 10 cm. The patient then returned to England, where the toxins were kept up with occasional intervals for a little more than a year from the time the treatment was begun.

The patient has remained in good health up to the present time, June, 1923, with no evidence of a recurrence, five years and four months later.

In this case the slide was submitted to Dr. James Ewing, who pronounced it definitely malignant, of the type which he designates "embryonal carcinoma."

TABLE OF CASES OF MALIGNANT TUMORS OF TESTES OBSERVED IN OPERABLE STAGE. END-RESULTS

I. OPERATIONS FOLLOWED BY PROPHYLACTIC TOXINS

Normal.	Age.	Date.	Duration.	Pathologic diagnosis.	Trauma.	Post-operative treatment.	End-results.
1. P. G.	51 yrs.	June, 1907; operation, Dec., 1908	6 mos.; size of closed fist	Round-celled sarcoma (Dr. Mandelbraum, Dr. W. H. Welch, Dr. J. Ewing)	No	Toxins of erysipelas given immediately after operation for 3 to 4 months (Dr. Lilienthal)	Patient well, March, 1923; about 15 years later.
2. R. M. M.	32 yrs.	Operation, Oct. 7, 1912 (Dr. C. C. Kimball)	3 mos.	Large round-celled sarcoma	No	Toxins begun soon after operation; continued several months	Patient well, March, 1923, 11 years later.
3. T. H. M.	28 yrs.	Operation, Dec. 2, 1910 (Mayo Clinic)	4 mos.	Sarcoma	Yes; tumor 4 weeks later	Toxins begun soon after operation; kept up nearly a year; temp. reactions, 104°; highest dose, 42 ♏	Patient well 8 yrs. later; died of influenza, Nov. 21, 1918.
4. J. E. B.	37 yrs.	Operation, June, 1908 (Dr. John B. Murphy)	Few months rapid growth	Round-celled sarcoma and undescended testes; diagnosis confirmed by Dr. Ewing	No	Toxins begun as soon as wound healed; kept up with intervals of rest for 6 months	Well for 3 years, then developed metastasis of abdomen; died at end of 3 years and 9 months.
5. Dr. Robinson's case	44 yrs.	Removal of right testis (Dr. J. A. Wyeth), 1899; 1 yr. later recurrent in left testis	Few months	Round-celled sarcoma of right testis; patient refused to have recurrent left testis removed	No.	Toxins for 6 months (carried out under Dr. Coley's direction)	Patient personally examined 8 years later; well 15 years later, when last heard from.
6. J. P.	Adult	Removed, Nov., 1910 (Mayo Clinic)	Few months	Sarcoma	0	Toxins begun soon after operation; kept up 3 to 4 months	Well; 7 years.
7. G. J.	37 yrs.	Dec. 10, 1910 (Coley); size of orange	7 mos.	Terotoma, typical (Dr. Ewing)	No	Toxins after operation	Well 3 yrs. later.
8. E. O. T.	46 yrs.	Feb. 23, 1906	3 mos.	Round-celled sarcoma	No	Toxins 1 month after operation; recurrence in glands (inguinal and iliac) had taken place	Well 8 yrs. later.

9. W. M. H.	26 yrs.	Operation, Feb. 1, 1906	3 mos.	Round-celled sarcoma	Yes; soon after	Toxins begun 1 month after operation; continued several months	Well, Dec. 22, 1922, 17 years later.
10. L. G.	24 yrs.	Operation, Nov. 2, 1917	3 mos.	Large round-celled sarcoma; pathological report of M. Schofield, Pathologist to the Royal Free Hosp., Lond., confirmed by Dr. J. Ewing (embryonal carcinoma)	Yes; 4 mos. before	Toxins, Feb. 3, 1918; 1 dose of radium pack given Mar. 18; 2d pack, Sept. 18; toxins kept up nearly 1 yr.	Patient well, Feb. 1923; 5 years.
11. R. H.	20 mos.	1st operation, April, 1917; 2d operation, June 1917 (Dr. D. P. Murphy); 3d operation, Oct., 19, 1917 (Dr. Coley)	3 wks.	Sarcoma of testés (Dr. Ewing); one of few cases Dr. Ewing has seen which he believes is a true sarcoma of testés	Yes; a few months before	Toxins begun immediately after 3d operation (removal of very large fungating recurrent tumor); toxins kept up 2½ yrs., with rest intervals	Patient in good health, March 1923; 5½ years.
12. S. S. S.	42 yrs.	1st operation, 1902 (Dr. M. J. Seelig, St. Louis)	Recurred 1919; retroperitoneal tumor and large metastasis in left supraclavicular glands	Large round-celled sarcoma (Dr. Councilman, Prof. Pathology, Harvard Med. School)	No	Roentgen-ray (Mayo Clinic), May, 1919; temporary relief; tissue incision in legs; toxins, July, 1919; radium, Aug., 1919; treatment kept up 3 yrs.	Patient well; free from all evidence of tumor, March, 1923; 3 yrs. and 8 mos.
13. J. D.	32 yrs.	Operation, Dec., 1908 (Coley)	0	Carcinoma (Dr. Ewing)	No(?); possibly from truss	No toxins	Well 4 yrs. later; only case in similar series well 4 years after operation.
14. E. L. F.	42 yrs.	Operation, Nov 22, 1907 (Dr. C. A. Porter, Boston)	3 mos.	Round-celled sarcoma	No	Toxins begun 3 weeks after operation, in groin (by Dr. Faulkner under Dr. Coley's direction)	Patient well 14 years, then recurred in other testis; removed; died; confirmed by misc. exam.

TABLE OF CASES OF MALIGNANT TUMORS OF TESTES OBSERVED IN OPERABLE STAGE. END-RESULTS.—(*Cont.*)

I. OPERATIONS FOLLOWED BY PROPHYLACTIC TOXINS

Normal.	Age.	Date.	Duration.	Pathologic diagnosis.	Trauma.	Post-operative treatment.	End-results.
15. S.	..	Recurrence in iliac and abdominal glands	..	Sarcoma	..	Toxins; apparent complete disappearance of tumor	Well 3 years, then died of recurrence.
16.	43 yrs.	Operation in summer, 1910; 2d operation (incomplete) in Aug., 1910 (Dr. Percy Shields)	..	Sarcoma	No	Toxins after second operation; glands disappeared; treatment continued for 1 year	Well 10 yrs. later.

CASES TREATED BY OTHER MEN

Name.	Age.	Date.	Duration.	Pathologic diagnosis.	Trauma.	Post-operative treatment.	End-results.
Dr. Robbins' case referred to by Hinman (Jour. Am. Med. Assn., Dec. 5, 1914)	55 yrs.	1st operation, Jan., 1909; 2d operation 15 days later; recurrence	..	Sarcoma	0	Toxins	Disappearance of tumor; remained well for 4 yrs; then died of nephritis; no evidence of old trouble.
Dr. Wm. Mabon's case, Manhattan State Hosp. (personal communication)	..	Testis removed in 1890; recurrence in tongue five years later	..	Testis: sarcoma; tongue: round-celled sarcoma (Dr. Wm. H. Welch)	0	Toxins	Well 15 yrs. later.
Case of Dr. Hertel, of Copenhagen (Hospitalstidente, April 7, 1909)	29 yrs.	Three recurrences; 3d operation was Leunander's operation (incomplete)	..	Sarcoma	..	Toxins	Glands disappeared; well 10 years.

Conclusions: The number of permanent cures following surgical removal of the testicle for malignant disease, is comparatively small, the proportion being not over 5 to 10 per cent. This number of cures, in our opinion, is not sufficiently increased by the radical operation of removal of the retroperitoneal glands by the abdominal route to warrant the very considerable risk of such an operation.

Long-continued systemic treatment with the mixed toxins of erysipelas and Bacillus prodigiosus, combined with thorough radiation of the abdomen and supraclavicular glands by radium or roentgen rays, offers a far better hope of a permanent cure than any form of operative treatment alone.

If one waits after operation until a recurrence has taken place, marked regression of these recurrent tumors, and in some cases complete disappearance, may be expected from radium treatment; but in the great majority of these cases the regression or disappearance will prove only temporary, and death from extension of the disease will occur.

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DISCUSSION ON THE PAPERS OF DRS. MAURY, ROBINS, LOWER AND COLEY

Dr. Bransford Lewis, St. Louis, Mo.—I wish to speak briefly of two points: I was very much interested in the valuable contribution of Dr. Maury on ureteral complications following injury in operating, and the one point I wish to speak of is with reference to leaving catheters in the ureters after they have been anastomosed into the dome of the bladder. I believe there is one point about that which might be amended slightly in leaving catheters for a longer period. I do not know how long Dr. Maury left the catheters in.

Dr. Maury.—The catheters were not left in the ureters but put into the bladder.

Dr. Lewis.—I would suggest that ureteral catheters be left in the ureters long enough to maintain dilatation of the ureteral orifices, a point at which there is liability to contraction. Contraction of the orifice may happen in one ureter and not in the other; or contraction may be an inch above the orifice. A catheter left in the ureter for two weeks would not do any damage but might do much to maintain patency of the channel. I have left catheters in the ureters for a period of two or three weeks in certain cases without incurring any particular damage. If there is a tendency to infection by the presence of the catheter it can be overcome by the regular use of argyrol or lunosol solution through the catheter.

The other point I wish to speak of is in connection with Dr. Lower's contribution on the various mechanical aids in diagnosis. In my experience it is not always easy to determine the presence or absence of stone in the ureter. In some cases the stones are small, and although the patients may give you typical histories, the roentgen ray may fail to show them. The injection of a staining solution will assist you to find them where the roentgen ray fails.

One sign I have found of value in differentiating phlebolith from stone, and have reported[1] within the last year or so, is that in using a roentgen-ray catheter and finding the shadow apparently in contact with the catheter, you withdraw the

[1] American Journal of Urology, December, 1922.

catheter and take another picture with one of the metal ureteral dilators which I use in connection with my operating cystoscope outfit. As the catheter is soft it follows the normal course of the ureter which happens to be in the line of the shadow. The metal instrument being stiff and rigid straightens out the ureter, taking it away from the shadow if it be phlebolith, but maintaining the contact if it be stone. The differentiation between calculus and phleboliths is then plain and decided. I have found it useful in a number of cases.

Dr. Charles G. Mixter, Boston, Mass.—Dr. Robins' case represents one of the very satisfactory results we see in the treatment of malignancies of early childhood. In childhood we see malignancy appearing more frequently in the kidney region than elsewhere. We find malignancy of two kinds: (1) The mixed tumor, and (2) the neuroblastoma of the adrenal. Of the cases we have had at the Children's Hospital that were operated on or in which the diagnosis was confirmed by autopsy, they occurred in the proportion of 26 mixed tumors to 5 of the neuroblastoma. With invasion in the child the first symptom is the finding of a tumor by the parent. One important factor that should be emphasized is the necessity of examination under a general anesthetic in all cases of infants presenting a certain amount of resistance in either loin. The administration of a general anesthetic will relax the muscles sufficiently so that you can feel the tumor earlier than you could otherwise palpate it.

Our results have been unfavorable in this class of cases. We have only one case that has lived for a long period, four and a half years since operation. This case differs in no way in the operative findings from the cases that died within six months or a year, which is the usual course. I see very little prospect of improving statistics except by getting the cases early and then following them up by radiation of one form or another.

Dr. Francis R. Hagner, Washington, D. C.—I have been very much interested in the paper of Dr. Lower. What he said about specialism is important. It is very essential to impress upon students that they are not to start out with the idea of becoming specialists. A man needs not only a good surgical but medical training before he takes up a specialty.

We owe it to students to impress upon them this important fact.

With reference to the diagnosis of ureteral calculus, I believe that stereoscopic pictures help us materially. We make it a rule in every case to have stereoscopic pictures taken with the roentgen-ray catheter which will show a shadow in front of or behind the catheter. In a large percentage of these cases you meet with obstruction, and usually by manipulation of the catheter it is possible to pass the calculus, and, if retention of urine is found on passing the obstruction with confirmation by roentgen ray, we can feel sure a calculus is present. The waxed-tipped catheter will clear up those cases that are more difficult to diagnose.

I have had only a limited experience with the use of radium after the removal of the testicles. We have had three patients with malignant disease of the testicles, one of whom is alive at the end of two years and the other two are alive at the end of three years without any sign of recurrence. In one of these cases the glands are palpable on one side. The testicle was removed and radium applied along the course of the glands. I do not claim the radium affected a cure, but the patients are alive and well, and that, we know, is not the usual history in cases of malignant diseases of the testicle.

Dr. Rufus B. Hall, Cincinnati, Ohio.—In reference to Dr. Maury's case and the discussion of Dr. Lewis, the patient was said to have a tumor filling the pelvis. It would be advantageous if we could have the ureters catheterized in these cases to demarcate the ureters. In some cases it is difficult, many times impossible, for a man to pass a catheter up the ureter if he wants to do it. Dr. Maury said the tumor filled the pelvis and the ureter was drawn up out of the pelvis, and in that type of case it is often impossible to pass a catheter up the ureter even if one desires to do so. That is the first point.

The next point is that the doctor, in describing the case, said there was a stricture at the entrance of the new implantation of the ureter into the bladder; that the catheter passed up an inch or so and the stricture was beyond. My opinion of this case is that there was contraction of the scar tissue formed after operation binding down the ureter *above* and not at the entrance of the ureter into the bladder. Therefore, a catheter placed in the ureter during operation and remaining a week or

two would not have prevented a stricture following because of contraction of tissue, and notwithstanding the operation the doctor would have had a stricture just the same. It was not the fault of the operation at all.

Dr. Hugh H. Trout, Roanoke, Va.—I believe we will find the question of postoperative radiation following nephrectomy simplified very much if we employ massive dosage of radium. This is done by means of using numerous small needles spread around over a large surface so as to cover as near as possible the entire area from which the kidney has been removed. Of course these needles can be withdrawn, and a good method is to pull on the strings which go out through the drainage tract, so that the needles come out about an inch every hour. We have had no experience with cases as young as Dr. Robins, but have had with older patients, and believe our results justify the continuation of using radium in the above-mentioned manner. We first called attention to this manner of using radium in an article[1] entitled "Retroperitoneal Sarcoma," relative to its employment in those cases in which the sarcoma could not be completely removed, and the needles were planted against the part of the tumor remaining. Radium applied in this manner, I believe, will be found more effective than the postoperative use of roentgen ray, though, of course, there is no contraindication to the employment of both.

Dr. Harley R. Shands, Jackson, Miss.—I have seen one case of sarcoma of the testicle or a mixed tumor in which such a phenomenal result was obtained after the use of Coley's toxins that I think it is worthy of reporting, and briefly I will give you the facts:

The patient was Mr. G. N., of Hazlehurst, Mississippi, a Confederate veteran and planter. I saw him ten years ago, when he told me that he had had a small tumor in the left testicle for fifteen to twenty years. Some months prior to my seeing him the tumor began to grow rapidly, so that at the time I saw it, it was an oval tumor seven inches long by three or four inches across. His condition was extreme when

[1] Surgery, Gynecology and Obstetrics, December, 1920.

I saw him. With a trocar I tried to get some kind of fluid out of the tumor, but found it was a solid growth. I told the family I thought the case was hopeless. We did not have any radium at that time. Happening to have a supply of Coley's toxins in my office, we began to give it at first away from the tumor. The patient would get a sharp reaction with temperature of 104° from its use. Later, we gave it in the tumor. Within a period of three months the tumor diminished to the size of a lemon. The patient thought he was going to die at first but improved steadily and rapidly under the use of the toxin. A year later, when the tumor had been reduced to the size of a small lemon, I begged him to have it removed, but he would not give his consent to have this done. He lived eight years and then died of another disease, with no recurrence of trouble in the testicle. He had no treatment whatsoever except Coley's toxins, and the tumor caused no inconvenience during the remainder of his life.

I saw the patient in consultation with Dr. E. H. De Berry, of Hazlehurst. Dr. De Berry administered the toxin to him. He reported this case in full to Dr. Coley, but for some reason it does not seem to have been included in Dr. Coley's series. This patient made as wonderful a recovery as I have ever known any patient to make from any form of treatment. We were never able to get a specimen of tissue for microscopical examination, for the patient declined operation after he had improved so much with the toxin treatment. Clinically, it was certainly a very rapidly growing solid tumor of the testicle, usually classified as a sarcoma or mixed tumor.

Dr. Maury (closing on his part).—In looking over the literature on the subject of ureteral injuries and ureteral repair, one finds a great deal written, but it deals with the immediate results which are really the results of the operation itself. The ultimate results, of what becomes of the kidney and ureter, except in a few instances, are given no attention. I finally came across a paper of Dr. Peterson's which was read before this Association in 1920, and he stressed the same point that had impressed itself upon me, namely, there is little in the literature to show what the ultimate results are. In this case I believe there was a stricture of the left ureter, as has been said, the result of cicatrical contraction from tissues outside. There was no trouble about the ureteral orifice, at the point

where the incision was made and the suturing done, where we would expect to find trouble afterward. I do not see how leaving a catheter in the ureter could have effected the cicatricial contraction from the outside.

Another point: I was in hopes that something would be said about the retention of creatinin and urea nitrogen, as shown by the laboratory findings in this case three months after operation. The retention was almost double the normal. It is difficult to see how such a condition could be brought about unless there was some damage to the kidney resulting from the operative procedure. There were a few granular casts in the urine before operation, but these are frequently found in connection with large fibroids. I do not think there was any disease of the kidney. The clinical condition of the patient at the time of the examination, which was made three months after operation, was such as to make one doubt somewhat the laboratory findings. Either the patient stood the retention very well, without any symptoms, or there was some error made in the laboratory examination of the blood.

Dr. Lower (closing on his part).—The point I want to make is this: If the surgeon has a completely equipped table the patient will not be subjected to unusual annoyance and the time required for the examination will not be prolonged. Thus these problems can be worked out without having the patient move from place to place and without too much special technic. I think when general surgeons appreciate that this can be done without a great amount of special skill, most of them will avail themselves of the opportunity of working out these problems themselves.

Dr. Coley (closing).—Before referring to my own paper, I should like to report a case of sarcoma of the kidney in a child from Kansas City, Missouri, aged two and a half years. The patient was seen twenty years ago with a very large sarcoma of the kidney, which was removed, and the patient given toxins for two years afterward. The patient was reported to be in good health when last heard from twenty years thereafter.

Let me mention one other case: I have removed only one sarcoma of the kidney in an infant, and that patient died within a few months afterward.

There is one other case in an adult, the case of Prof. Shields of the University of Sheffield, England, who sent me personal data. I reported the details of the case in a paper read before the International Cancer Research Congress in Brussels in 1913. This was a large malignant hypernephroma in a woman which was at first considered inoperable, but was later removed by operation. The patient recovered, but in less than a year had a large recurrence, the mass being considered inoperable. It disappeared under toxins. I heard from Prof. Shields two years later, at which time the woman was in perfect health.

Regarding malignant tumors of the testis, it seems to me if we attempt surgery we can cure only a small number of cases. If we find 10 out of 11 prophylactic cures after operation, and the patients are well for three years, we can conscientiously operate on sarcoma of the testis and remove the mass without any prophylactic treatment. While radium alone, used as a prophylactic after operation, may destroy the disease in the abdominal glands in a certain number of cases, we do not, as yet, know how many it will cure; we have not sufficient data. Of Dr. Barringer's 3 cases treated at the Memorial Hospital, 1 has remained well nine months, 1 died, and 1 has not been traced. Is it not wise to get all the help we can from the local effect of radium over the abdominal glands, and, at the same time, take advantage of the systemic effect of long-continued toxin treatment after operation in the hope of curing the patient?

Hertzler, of Copenhagen, in 1909, reported a case on which he operated for the third time for recurrent sarcoma of the testis, finding the glands up in the iliac fossa beyond reach. The tumor disappeared under the use of toxins. He wrote me a letter stating the patient was in perfect health to ten years afterward. How long the toxins should be given I do not know. In some cases they have been given for a period of three to six months. One case had three rapid recurrences in three months; was given toxins for three or four months, came back in a year and a half, and the nodule, having greatly decreased in size, was removed and toxins given. At the end of two and a half years I gave further prolonged treatments, and the child was well at the end of five years and two months.

One thing is certain, the toxin treatment may prolong life for a number of months and even for a number of years without causing any harm to the patient. In these prophylactic cases,

if given in moderate doses, not sufficient to produce severe reactions, the treatment will not seriously interfere with the patient's daily routine of life. I would say that, in an ordinary case, treatment for six months would be sufficient.

Regarding late recurrence, Dr. C. A. Porter, of Boston, referred a case to me, fifteen years ago, in which prophylactic treatment with toxins was given after operation. He carried out my directions, and the patient was free from the disease for some fifteen years, when he had a recurrence in the other testicle.

SPONTANEOUS HEMATOMA OCCURRING IN A CASE OF SPINDLE-CELL SARCOMA OF THE KIDNEY

By Frank K. Boland, M.D.
Atlanta, Ga.

Many cases of rupture of organs without an external or penetrating wound have been reported. The liver, spleen, kidney, stomach and intestines have been ruptured in this manner. Of all organs exposed to such an injury, the kidney appears to be the most susceptible. Küster,[1] Herzog[2] and others have recorded several cases; the writer has reported three.[3] Küster[4] believes that such rupture is due to hydraulic pressure within the kidney. Other writers attribute the injury to pressure of the distended kidney against the transverse processes of the vertebræ or to the pressure of the ribs or the diaphragm or other muscles. Severe muscle strain from pulling, jumping, lifting a heavy object or a sudden twist of the body have been mentioned as causes.

If such factors as these may rupture a normal kidney, it is not remarkable that a diseased kidney might burst from less force or from no apparent extrarenal force at all. A few cases of spontaneous rupture of pathological kidneys are to be found in the literature. It is not believed that a perfectly normal kidney could rupture spontaneously. Wunderlich[5] described the condition in 1856 and called it spontaneous apoplexy of the capsule of the kidney. Lippens[6] in 1913 collected 23 cases, 2 of which were bilateral, and Wade[7] in 1915 stated that 30 cases had been reported.

The common underlying pathological cause has been acute or chronic nephritis. The case described by Thomas[8] occurred in a hydronephrotic kidney filled with stones. In some instances a hematoma has formed under the capsule of the kidney, but usually the capsule ruptures and blood escapes into the perirenal fat, producing a large hematoma.

The present case is spoken of as spontaneous hematoma instead of spontaneous rupture, because the hematoma, on account of its enormous size, was the outstanding picture rather than the comparatively small rupture. The case is unique for two reasons: (1) Because the writer has been unable to discover in the literature the report of a similar condition occurring in a neoplasm of the kidney, and (2) because the rupture of the kidney and formation of the hematoma were the first signs of the disease manifested in the case. Previous to this time the patient had been in good health and presented no symptoms which would lead one to suspect her of having anything wrong with her kidney. Apparently the rupture occurred early in the course of the disease.

History of the Case. The patient was a white female, aged fifty-one years. She was the mother of two children, the youngest aged seventeen years. Her past history included nothing important, except that several years ago she had a vaginal hysterectomy for prolapsus, which operation had given satisfactory results. At 10 a.m., August 23, 1922, while walking on the street, she was seized with a sudden violent pain in the left loin, accompanied by extreme weakness, faintness and nausea. She was taken home and seen by her physician within two hours of the onset of the condition. He found her in a state of collapse, with a very weak pulse, a distended abdomen, and an easily discernible mass in the left loin. She was then vomiting, and on account of this symptom, and the distention, his

first thought was of intestinal obstruction. High enemata, after several trials, gave a large evacuation of feces and gas, and the general condition of the patient improved. Six or eight hours later she relapsed into a state as bad as the first, and the mass in the loin had reached its maximum size. The pain was still very severe and morphine was given. The abdominal distention recurred and was relieved with difficulty by draining the colon.

It was not known whether the patient voided urine while expelling the enemata, but twelve hours following the beginning of the attack 8 ounces of urine were obtained by catheter. This specimen was perfectly clear, acid, with a specific gravity of 1026, no albumin, sugar, pus, nor blood, and no other abnormal elements except a few hyaline casts.

The patient was first seen by the writer, in her home in a small city of the state, thirty hours after she was taken sick. She lay very quietly and could not bear to be moved. She was again markedly distended and a high colon irrigation brought away much gas and the dark fluid from previous injections. She had passed about 20 ounces of urine since the trouble first began, and the examination of a second specimen was negative for abnormal constituents. She had drunk some water and had sweat a great deal. Any movement brought on nausea. Her pulse was 90, regular and weak; respirations 20 and shallow; temperature 99½.° Blood count showed 8000 luekocytes. Heart and lungs were negative. No swelling of the extremities. Pelvic examination threw no light on the condition.

The mass in the left loin was the size of one's head and extended toward the pelvis. It was exquisitely tender, hard and immovable. Gentle inflation of the descending colon with air showed that the mass was postperitoneal; it could not be the spleen; it must be the kidney or about the kidney. The case gave one the impression of hydronephrosis, due to sudden kinking of the ureter or blockage by a stone. The real condition was not suspected. There

was no roentgen-ray equipment available, and the weakness of the patient and difficulty of moving her seemed to contra-indicate the use of the cystoscope. A kidney functional test was not performed. The acuteness and severity of the case, without any previous history as a guide, called for an exploratory operation.

Under ether anesthesia a posterior oblique incision was made over the left kidney. The mass proved to be the kidney enveloped around its lower pole by a hematoma 22 cm. in diameter, apparently held within the perirenal fat. The whole was easily loosened and delivered, with but very little bleeding. Hemorrhage from the kidney seemed to be stopped. It was observed that a new growth, 5 x 7 cm. in diameter, probably malignant, covered the lower third of the organ. The remaining two-thirds, though normal in color and consistence, seemed to be shrunken, and the renal vessels and ureter were undersized. From this it was inferred that the kidney was performing but little function. A nephrectomy was done, since the patient's previous good health warranted the belief that the other kidney was excreting normally. The weight of the hematoma attached to its lower pole pulled the kidney down and out of its bed to such an extent that its removal was greatly facilitated.

Examination of the excised organ showed that it had "blown out" at its lower pole through the tumor, producing hemorrhage and the enormous hematoma. What excited the rupture at this particular time could not be determined. It could not be proved that a large vessel had become invaded by the growth. The diagnosis of the neoplasm, by Dr. John Funke, was spindle-cell sarcoma, with atrophy of the portion of the kidney which was unaffected by the growth. On account of the fatty tissue found in the tumor he thought it may have started as a lipoma.

The patient passed 8 ounces of urine twelve hours after the operation, and the amount gradually reached normal.

The urinalysis report a short time ago was negative, and recent skiagrams have failed to show any metastases. She has received several exposures to deep roentgen-ray therapy, and her condition today seems excellent. In the presence of a malignant growth, rupture of the kidney was considered a fortunate circumstance; otherwise the disease probably would have been much further advanced before it was recognized.

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IS THE PROFESSION PAYING THE PROPER ATTENTION TO SURGICAL CLEANLINESS?

By Southgate Leigh, M.D.
Norfolk, Va.

"Where strict and reliable asepsis cannot be had and safely maintained, the abandonment of the antiseptic principle in the operating room is a mistake. Even where asepsis is reliable, we must in certain cases be ready to return to the use of irrigation and antiseptics. Serious lapses from asepsis do still occur in the best-managed hospitals, and are apt to be followed by fatal consequences." These words from Arpad Gerster, the man who, more than any other, introduced and made popular the principles and practical details of antisepsis in this country, carry with them a warning which should be kept always fresh in the mind of every careful surgeon.

Gerster, a native of Hungary, came to this country early in 1874 and settled in Brooklyn. Marcy, of Boston, had accepted and was practising Lister's methods before that time. He was Lister's first American pupil and has already related before this Association his delightful experiences during the summer of 1870 in Edinburgh, and also the professional ostracism practised by the doctors of England toward the new theories and their author.

Dr. Marcy's account of his own reception by the profession of Boston is most interesting, and especially when they went so far as to exclude him from a large city hospital

because they claimed that he advocated "a foolish technic, promising to revolutionize surgery."

On his way to America, Gerster visited Volkmann's Clinic at Halle and learned that that eminent surgeon had enthusiastically accepted and was putting into practical effect Lister's teachings, and with the most brilliant results, primary healing of wounds being obtained for the first time. Gerster gives it as his opinion that Volkmann was the "real disseminator of antisepsis."

Although treated with ridicule in his own country, Lister's methods were promptly and practically adopted by Volkmann and other German surgeons.

Before their change to antisepsis, mortality in surgery and obstetrics was exceedingly high, hospitals being veritable nest-beds of contagion, practically every wound becoming violently infected, and frequently with erysipelas and gangrene. In obstetrics 1 in 29 died in hospitals, usually with puerperal fever, while the death-rate outside was 1 in every 112; 40 per cent of all amputations were fatal in hospitals, while the death-rate outside was 10 per cent.

On Gerster's arrival in this country there was hardly a trace of evidence of the new doctrine, general unbelief and hostility being the rule. His fight was a difficult one, but he was later joined by Keen, of Philadelphia; Senn, of Chicago; and by Lange, Weir, Sands and McBurney, of New York. One of Gerster's early operations in Brooklyn was amputation of the thigh, and was performed in a room over a stable. He invited several prominent New York surgeons to be present, and carried out as strictly as he could the antiseptic rules laid down by Lister, and as he had seen them practised by Volkmann. The wound, instead of being left open, as was the fashion in those days, was closed with drainage. The assembled surgeons were much shocked by this procedure, and predicted dire results. A week later, however, they were astounded to see that the parts had healed by first intention.

In 1876, Lister visited Philadelphia, and Dr. Keen then fully accepted his theories and became a staunch advocate, stating in a paper on the subject that Lister had changed surgery from "Purgatory to Paradise." Keen also commended Volkmann for his good results, "obtained in a most unsanitary hospital." The acceptance of the antiseptic theory must have been very slow and gradual, since Keen makes the statement that as late as 1883 "no prominent surgeons of certain large cities had as yet accepted it."

In the meantime Gerster had been practising antisepsis in connection with his general work in Brooklyn, until 1877, when he moved to New York to accept a position on the staff of the German Dispensary, and in 1878 was appointed visiting surgeon to the German Hospital, and in 1880 visiting surgeon of Mt. Sinai Hospital. In these positions he had wider opportunities of developing his wonderful talents. His book on aseptic and antiseptic surgery appeared in 1888 and quickly went through three editions. It was written and illustrated in such a practical and common-sense manner that its influence became widespread and effective throughout the entire country.

The writer had the privilege of serving under Gerster at Mt. Sinai from 1889 to 1892, and can bear witness and positive testimony to the thoroughness with which antisepsis was practised at that institution under his dominant leadership. It required sledge-hammer blows to instil into the minds of doctors and nurses the vital necessity of attention to every detail of antisepsis; but by following his directions to the letter, we had the great satisfaction and joy to find that our results were practically perfect. During the last thirteen months of my term as house surgeon there was not a single clean wound infected. In order to obtain these wonderful results, it was necessary for Gerster to be exceedingly strict, and at times very severe, so much so that in his "Recollections" he acknowledges that as a result he was called a "martinet." But in those times he

could have gotten the results in no other way. He used sledge-hammer blows, but he got what he was after. His severe criticisms were often difficult to bear, but the members of his staff will ever be grateful to him for thus imparting to them some of the wonderful thoroughness which was always characteristic of the man. His greatest delight was to see the splendid results of his work, and his charity cases interested him even more than his private ones.

Gerster was and is a great man. American surgery owes him a debt that it can never repay. But for his dislike for publicity and extreme contempt for vanity, he would be as well known to the younger surgeons of today as to the older ones.

At that wonderful "School of Surgery" in Rochester, where egotism is unknown and where those modest, unassuming men are doing so much not only to relieve suffering humanity but even more to uplift the profession, Arpad Gerster is given full credit for what he did in giving Listerism a good start in this country and in quickly driving the doubters and scoffers to cover.

But to return to Mt. Sinai. Schimmelbush had not yet suggested the use of soda in boiling instruments, which were so badly injured by plain water that boiling was done only for laparotomies. Otherwise the instruments were, after each operation, given the most thorough possible scrubbing with soap and hot water, soaked in 5 per cent carbolic and then dried. Before operation they were again soaked in the same solution and kept immersed throughout the operation in a 3 per cent solution, the strength being reduced to this on account of injury to the skin of the hands. The hands and forearms of the operator and assistants were most thoroughly cleansed with scrubbing brush, nail file, hot water, alcohol and 1 to 1000 bichloride. During the operation the hands were frequently immersed in the same strength of bichloride.

The patient's skin was well prepared, beginning the day

before with shaving, soap and water, alcohol and bichloride, followed by a wet dressing of 1 per cent carbolic, kept wet by covering with rubber tissue, and left on until the operating room was reached.

The operating room, which was kept free of dust, was used for both clean and dirty cases. On its table, which was of wood, padded and covered with leather, and with two deep grooves for drainage, the dressing was removed, and the scrubbing brush used vigorously with soap and water, followed by ether and then bichloride. Instead of dry towels wet bichloride towels were used to surround the field of operation. The irrigator, filled with 1 to 3000 bichloride, was used frequently throughout the operation, the room after operation looking as if a flood had struck it. Nurses and doctors protected their feet by using large wooden shoes. All gauze was sterilized by boiling in the laundry and then soaking in bichloride solution and drying. Iodoform gauze was prepared by a most elaborate method, the iodoform being soaked in bichloride, which was carefully decanted off, and then sterilized water added, and also drawn off. Sterile gauze was then impregnated with the paste, folded and put into sterile jars. Catgut was also safely prepared by an alcohol and bichloride method. Although sea sponges were used in operations, yet they were treated by such strong antiseptics that they must have been sterile.

We have thus given a brief account of this period, and especially of the work of Gerster, to show what wonders were performed by antisepsis and largely by chemical agents.

It is interesting also to note that, notwithstanding the statements of recent authors, we had but one case of bichloride poisoning, and that not fatal, and found no practical evidence of interference with healing by using bichloride or carbolic freely on the tissues. It is true that in those days the wound was always sutured loosely and a fair amount of drainage material employed. Steam sterilizers had not been adopted

and rubber gloves were not yet used. Instruments were boiled only for laparotomies. The skin was prepared more thoroughly than nowadays, the scrubbing brush being especially in evidence. The fear of disastrous results from infection was always uppermost in the minds of operators and assistants, and stimulated them to extreme care and attention to details.

When, after a year's absence, I returned to Mt. Sinai, I was shocked to find an epidemic of infection, which was not confined to that hospital but extended all over the city of New York. It was probably due to the introduction of flat-top glass operating tables, which had no drainage gutters, causing the soaking of the patients from head foot when either washing or irrigating was done. Steam sterilizers had been introduced and instruments were being boiled for all operations. For a while the situation was both puzzling and alarming. It was found that the skin of the operated parts was being prepared only in the wards. As soon as scrubbing on the table and irrigation were resumed the results were again satisfactory. I mention this occurrence for a purpose. So-called "asepsis" had been substituted for "antisepsis." In other words, antiseptic agents were not being used freely enough, considering the fact that all kinds of cases were being treated in the same room, and that gloves had not been introduced. With the advent of steam sterilizers and the boiling of all instruments, antiseptic methods became greatly simplified.

It was interesting to note the difficulty with which the older surgeons adapted themselves to the antiseptic methods. They would frequently go through the most elaborate details in preparing the hands and the patient, only to completely spoil it all by thoughtlessly changing their glasses with their sterilized hands. This also demonstrated the fact that is now apparent to all thoughtful men, that a hospital intern training is essential to every surgeon. Surgery cannot be learned from books. A thousand and one small and large

details can be gained only through a good hospital service. To be a clean surgeon one must be brought up to be clean. It should be so natural to be clean in the operating room and wards that any breach of cleanliness on his part, or the part of his assistants, should be immediately and shockingly apparent.

And does not the same principle apply to surgical training in general? To be a safe surgeon one must have served an apprenticeship with a surgeon who is careful and safe in his work and technic.

The advent of gloves was a blessing in a way and a disadvantage in others. At first many surgeons used gloves most widely in dirty cases to keep their hands free from infection. Later, when they came into more general use, the question of proper sterilization arose, and is still an unsolved one.

As stated in a former paper, the speaker is frankly of the opinion that surgical cleanliness has not in the past few years gone forward, but probably backward. If this is correct, it is inexcusable, and especially in view of the fact that all up-to-date hospitals now have complete laboratories, which can and should make frequent and thorough tests of the operating rooms, instruments, dressings and workers. The principal cause of infection comes from the fact that the operator does not assume full responsibility for the training and watching of the operating-room staff. In many large institutions this is difficult, and yet the matter is of such vital importance that safe arrangements should be made. In former years, in nearly every prominent hospital, in the surgical department there was one dominant figure whose standing and influence were so strong as to enable him to direct the policy of the work, even to minor details. Today, however, we have in each such institution many good and safe surgeons, with no one as the leader.

Why is it that so many surgical reports still refer to cases of infection? Why is it that, in these modern times, there

is scarcely a large hospital which does not report many cases of clean operations followed by infection? Why do we, not infrequently, hear surgeons who work in general hospitals, state that they are unable to attempt certain plastic procedures because such cases always get infected? The situation is a peculiar one. By many it is simply accepted, as a fact, that an occasional case will be infected and that such an occurrence cannot be prevented. On the other hand, every surgeon will readily admit that the necessary technical details to bring about the proper and uncontaminated healing of clean wounds are so simple and plain that they can be carried out to the letter by people of ordinary intelligence.

Then why should infection ever occur? Is it not well-nigh criminal to permit a perfectly clean wound to become poisoned by outside means, thus jeopardizing the comfort and safety of the patient? We cannot speak too plainly about these matters, and there is no subject before this or any other gathering of medical men that demands more prompt and more vigorous consideration and action.

The speaker has discussed the situation many times, both publicly and privately, with surgeons from various parts of the country. They, practically all of them, admit the unfortunate condition, but seem to be resigned to the same, and have no suggestions to offer in clearing up the difficulties. Fortunately for the patient (and this is why the profession has not become more aroused) the infections are usually mild, and while they may mar the results of the operations and prolong the time of recovery, with consequent increase in discomfort and suffering, yet at times severe and dangerous infections do occur, and may happen when least expected. The great trouble is that surgery appears so much easier than formerly, so many more men are attempting to do it, and the details of surgical cleanliness are so simple, that they are being overlooked, neglected, or left too much to subordinates who are frequently irre-

sponsible. The great importance of antisepsis is more deeply realized by men who began their surgical careers in the days when chemical antiseptics were largely employed and extreme attention to all details were essential in order to obtain clean healing of wounds. In those days they had to consider everything around them as carrying infection and had to wage a constant and relentless warfare against wound contamination. But the results were substantially as good as those of today. There is nothing more important than cleanliness. How much better would we all feel if we could be positive on this subject and not be in constant fear that the patient may become infected.

In preparing this paper we have been materially aided by the prompt replies received from a number of prominent surgeons to whom a questionnaire was sent. We were especially impressed with the fact that a very large majority of replies indicated infection of clean wounds, in most instances without known cause. The questionnaire was sent to 75 surgeons in widely separated sections of this country, with 61 replies. Of the 75 surgeons, 18 are doing their work in private hospitals and 43 in general or public institutions. In all of the private hospitals the surgical staff has complete control of the operating department, while in the public institutions the surgeons claim to have practical control in 35 out of 43. Only 9 report having no infections, 2 from private and 7 from public institutions. It is pleasing to learn from the replies that most of the infections are mild and that the situation seems to be improving. Lack of strict control is apparent in many cases. One surgeon reports as high as 10 per cent to 15 per cent infections. A few report that bichloride is used to some extent in the sterilizing of gloves. Several of the questions replied to will be mentioned under the appropriate heads. Frankly, we are disappointed at the showing made by the private hospitals. The problem with them ought to be much simpler on account of complete operating-room control.

In this discussion we are naturally brought now to the point of considering the chief causes of infection. Auto-infection, while possible, is rare. Naturally all cases having focal infection should have such foci attended to before undergoing extensive surgical operations. In enumerating the causes of infection we shall consider:

1. *Thoughtlessness on the Part of the Surgeon.* This state of mind is inexcusable and shows that the surgeon is not familiar with the history of the dark ages of surgery, and is not aware of the fact that carelessness may at any time bring the dark ages back again, and with most disastrous results. In other words, we must all of us constantly bear in mind that, notwithstanding the simplicity and ease with which operating-room technic is now carried out, we may at any time, unless we are strictly watchful, have a shockingly disastrous result. We have the same bacteria around us today as our forefathers had. There has been no modification in the virulence of those bacteria, nor have patients developed an immunity against them.

2. *Lack of Operating-room Control.* In the best-managed hospitals, where there are several men on the hospital staff, there is frequently lack of surgical control of the operating department. What is everybody's business is nobody's. Each man expects the others to supervise; the result is that everything is left to the nurses. That arrangement may be satisfactory if the nurse in charge is well trained in practical antisepsis, and is deeply imbued with the tremendous responsibility of her position. If not, the situation is a dangerous one.

In a hospital of this class the staff should select an exceedingly careful surgeon from its membership and put the responsibility of the operating-room on his shoulders, giving him one or more assistants if desired. He should be a man deeply imbued with the necessity of extreme care in surgical cleanliness, and preferably an extremist in his views on the subject. He should be given full authority over the assist-

ants and nurses of the operating department, investigating their work from time to time, instructing and conferring with them, watching each one of them with an eagle eye, and, in short, personally looking after every detail of their work in the conduct of the department. His good sense and tact will readily arrange the necessary rules for both nurses and doctors. With such a man the operating-room will be clean as far as it is humanly possible to make it so.

In those institutions where the staff has not such full control of the operating department, they should not be content until such authority has been obtained. With the help of the American College of Surgeons, which has in recent years done such revolutionary work, the change ought to be easily accomplished.

In a general hospital, open to all practitioners, the difficulty is greater. Even here the men doing the principal surgical work should not be content until the essential surgical control is secured. The problem is also greater because of the fact that not infrequently incompetent and poorly trained men may operate. Nurses and assistants are only too prone to follow the careless operator and become more or less negligent and inattentive. Here the man in charge of the operating room has a more difficult task, that of controlling the nurses and assistants and exercising a good influence over the careless operators. Patience, tact and good example, as well as regular reports to the medical board, will soon straighten out these difficulties.

In operating-room control the ideal plan is for each operator to have his own operating-room and personal staff of assistants and nurses. This is rarely possible except in private hospitals, where there is no earthly excuse for bad results in clean wounds.

3. *Gloves.* Here we have a real problem and one that is far from solution. From our questionnaire we found that very few surgeons use steam, one or two others hot air,

and the large majority boiling for not longer than ten minutes.

It would be best to use new gloves for all clean cases, but the expense of this would be almost prohibitive. Gloves stand steaming badly, however carefully it is done. Boiling is done for anywhere from five to fifteen minutes in various hospitals, the average being under ten minutes. They are cleaned after the operation and then boiled. The boiling is repeated before operation. Unless turned and boiled a second time the boiling is not sufficient, because air in the gloves prevents complete contact with the boiling water. Our replies would indicate that gloves are not being sterilized sufficiently. Punctures must be looked out for in the most vigilant manner. Patched gloves must not be used in clean cases.

In our questionnaire only fifteen surgeons reported using separate gloves for clean and dirty cases. Two, however, stated that they intended adopting the plan for the future. We have always used separate gloves, the ones used in dirty cases being marked by a small piece of red rubber cemented on the wrist. We boil our gloves as long as they will stand, and, as an additional precaution, soak the gloved hands in 1 to 250 bichloride, washing this off in a weaker solution. We would respectfully suggest this chemical sterilization for your consideration. It seems to have had no bad effect on the gloves. Repeated bacteriological examinations of such gloves at various times during operations have always shown them to be sterile.

4. *Catgut.* Ten replies to our questionnaire indicate that catgut has been causing trouble, one surgeon stating that he is using silk exclusively.

In 1919, Butterfield and Eley, from the Surgeon-General's Office, U. S. A., examined 15,000 tubes of catgut and found 11 per cent contaminated. They recommended that the preparation of surgical catgut be put under government supervision.

Practically every hospital now has a good laboratory, in which every lot of catgut should be tested. This means that we can practically eliminate catgut as a factor in infections in the future. Incidentally, it might be well to mention that on inquiry we have found that in but few hospitals is laboratory checking up being done regularly and frequently. Such bacteriological investigations should be made with great frequency in all hospitals, and especially where several operators use the same room. Nothing would more promptly stimulate careless operators to take greater precautions.

5. *The Non-use of Chemical Antiseptics.* Due largely, we think, to the physiochemists, the profession for many years has been gradually drifting away from the use of the good old antiseptics that in the early days were our life-savers. Lister employed carbolic acid freely and constantly. In the early 80's, German surgeons substituted bichloride of mercury for hands and wounds. As mentioned before, at Mt. Sinai Hospital we noted no interference with healing of wounds, notwithstanding the fact that bichloride was used freely in every case as a wash. We believe that too much stress has been laid on the supposed irritating effect of bichloride on the tissues. It would have been far better to stress the worse effect of bacteria. To get along without chemical antiseptics safely, the operators should have separate operating rooms for clean and dirty cases, with separate gloves and appliances.

Let us consider what the general situation is. In most hospitals both clean and dirty cases are operated upon in the same room, and, what is worse, septic discharges are permitted to soil the table and the floor, to get on gowns and shoes, and thus be distributed in every direction. One very prominent surgeon makes a great show of throwing pads and sponges, often septic, in every direction in the operating room, so that they may be more easily counted! With no precautions taken, clean abdominal cases fre-

quently follow dirty and septic ones in the same operating-room.

Operating-rooms and hospitals should be kept as clean and free from infection as possible. All septic materials should be collected promptly and destroyed at once by heat or chemicals. If a drop of pus should escape and soil the table or the floor, it must be sterilized quickly by an antiseptic solution. Nurses should use instruments where possible in handling such septic matter, and, when necessary, use gloves. Their hands and clothing should never become contaminated.

Everyone connected with the operating-room or the hospital should be taught to fear pus, to catch and destroy it promptly.

In the operating-room, hand solutions should be of bichloride and not of sterile water. Even theoretically, as far as bad effects upon the tissues is concerned, there is but little difference between the two, and bichloride certainly safeguards sterility more perfectly.

The use of antiseptics in wound dressings should be commended. In clean cases bichloride does less harm than the inevitable infection of an open, clean wound from skin and air. In septic cases it undoubtedly, to some extent at least, lessens infection.

Other antiseptics are also helpful in their places, including wet dressings of weak carbolic when indicated. The chlorine antiseptics, properly employed, have revolutionized the treatment of septic wounds, dichloramin-T for superficial and Dakin's for deep wounds. Discharging wounds should be kept securely padded with absorbent materials to prevent leakage, and dressing of all wounds should be done instrumentally, septic discharges and soiled dressings being promptly immersed in antiseptic solutions.

And, finally, when the surgeon is in doubt as to strict cleanliness being properly observed, let him here, at least, return in part to old-time methods and safeguard, by free

bathing or irrigating with bichloride solution. The same thought was in the mind of the English surgeon Godlee, when, in the second year of the Great War, seeing how utterly helpless his colleagues appeared to be in the management of the horribly infected shell wounds, and with such frightful mortality, he wrote his splendid article entitled, "Back to Listerism." In this he urged the profession to return to the freer use of chemical antiseptics.

I hope the Fellows of this distinguished Association will pardon me for having presented for their consideration a subject so elementary in its simplicity. My excuse is that having been brought up in the comparatively early days of antisepsis, when it required great effort to bring about a condition of surgical cleanliness, and feeling that many surgeons of a later date do not realize what that effort meant, and, further, being deeply impressed with the conviction that the question has been of late years badly neglected, to the disadvantage of both the profession and the public, I have felt it my duty, though with considerable hesitation, to discuss the matter before you.

I earnestly trust that my imperfect efforts, together with your full discussion, may result in renewed interest in the seriously important subject of stricter cleanliness in surgery.

Addenda

The Evolution of Antiseptic Surgery
(Notes Chiefly from H. S. Wellcome's "Sketch")

Antiseptics—Natural and Prehistoric:

The bee impregnates dead insects with formic acid.

Licking of wounds by dogs (antiseptic saliva).

Sacred serpents of Æsculapius taught to lick wounds. (Origin of Med. emblem.)

Early Ages:

Preservation of meat and fish by smoking and with natural salts.

Embalming of dead bodies by drying and washing with carbonate of soda later, oils, gum, resins and tar being used.

Under the Mosaic law, mention is made of the use of cedar and hyssop in obstetrics.

Sushrata, the Hindu father of surgery, advised the burning of aromatic drugs during operations.

Grecian and Roman Periods:

Hippocrates, B.C. 460, used wines, alum in vinegar, galls and the green bark of the fig tree.

Galen, A.D. 200, employed turpentine.

Rhases, the Arab, A.D. 850, was probably the first to distil alcohol, which he employed pure or mixed with astringent plants.

Middle Ages:

Little advance made—wine, alcohol, vinegar, sulphate of copper, honey and various plants were employed.

Seventeenth and Eighteenth Centuries:

1690, Leeuwenhoek, a Dutch physician, laid the foundation of modern bacterial technic by showing that by protecting meat with fine wire gauze no maggots were formed.

The word "antiseptic" was first used by Place in 1721, applying it to substances used to prevent or arrest putrefaction, and is derived from the Greek words "anti" (against) and "septikos" (causing putrefaction).

In the beginning of the eighteenth century, Delamotte, a French surgeon, strongly advocated, as a wound dressing, pledgets of cotton soaked in brandy.

In the middle of the century, Pringle, a British army surgeon, wrote a book entitled *Experiments upon Aseptic and Antiseptic Substances,* with remarks relating to their use in the theory of medicine.

With the view of preventing putrefactive changes, he experimented with salt, sal. ammoniac, niter, hartshorn, borax, etc.

At the same time, similar and more extended experiments were made by Madame d'Arconville, in France, in which she employed also bichloride, camphor, pitch, wines, lime, etc.

Period of Pasteur and Lister:

Early in the nineteenth century, Appert, a French confectioner, discovered a method of preserving meat, fruits and vegetables by excluding air and hermetically sealing, this being a great contribution to the principles underlying antisepsis.

Schwan, in 1837, proved that putrefaction was due not to air, but to something suspended in air.

In 1845, Semmelweiss, an Austrian physician, showed that puerperal fever, prevalent at the General Hospital of Vienna with high mortality, was due to infection borne from the dissecting room on the hands of students. He advised the cleansing of hands with chlorine or chlorated lime, with a consequent reduction in death-rate from 12.24 per cent to 1.27 per cent (this use of chlorine is interesting from the fact of the more recent introduction of the chlorine antiseptics).

Pasteur was the real founder of bacteriology.

The commencement of the new era came from the outgrowth of Pasteur's studies of the fermentation of alcoholic beverages. He showed that not only was this fermentation due to living organisms, but that many of the fermentations, including all putrefactions, were due to the same cause. In 1860, by extensive experimentation, he proved conclusively that pure air could not cause putrefaction.

In 1862, Tyndall confirmed Pasteur's conclusions and gave him full credit for his discovery.

In the meantime, the surgeons were still groping in the dark for some dressing to prevent the terrible mortality from wounds.

In 1865, Werner de Mulhouse suggested a dressing of venice turpentine, sod. bicarb. and water, and a little later, Bond revived the use of turpentine alone.

In 1854, carbolic was used by Lemaire, of Paris, and in 1855, at St. Mary's Hospital, in London.

In 1860, Lister, who had already commenced his bacteriological work in connection with antiseptics, was appointed professor of surgery to Glasgow University. At that time tetanus, erysipelas, septicemia, pyemia and hospital gangrene were prevalent in all hospitals and to a horrible degree. He began by insisting upon scrupulous cleanliness in the wards, frequent washing of the hands and frequent changing of dressings. He used various deodorant lotions.

Pasteur's researches in fermentation were the basis of Lister's work, which fact was repeatedly acknowledged by Lister.

Lister very soon began the free use of carbolic as a preparation for the skin, a dressing and a spray. He first applied the antiseptic principle to compound fractures, using crude carbolic and closed dressings, with remarkable results. Later he used carbolic 1 to 20 in solution and 1 to 4 in spray.

Lister served as professor of surgery at the University of Edinburgh, 1869 to 1877, where he still further developed his methods, which were hailed with acclaim in other countries, especially Germany, but were given an ungracious reception at home.

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DISCUSSION

DR. JOHN WESLEY LONG, Greensboro, North Carolina.—*Apropos* of Dr. Leigh's timely paper, I will say that an illustrious ex-President of this Association asked me recently where I had learned my surgical technic. My reply was that primarily I had learned it from Arpad G. Gerster, in the New York Polyclinic, in 1887. I would like to say in this connection the first paper I ever read before this Association was at its first meeting thirty-five years ago, and it was on "Aseptic and Antiseptic Surgery." However, in spite of my early training, and I say it with humiliation, I occasionally get an infection in a clean wound, and I do not always know why.

Referring to rubber gloves, there is one thing I do not quite understand. I have used new rubber gloves in operating on

septic cases, and after I got through operating, demonstrated the fact that there was no hole in the gloves, and yet there was a septic odor on the hands which remained for hours, even after several washings. I have asked myself the question, If the odor of sepsis can go through new rubber gloves, why cannot infection itself pass through?

Dr. Herman J. Boldt, New York City.—There is no question about the large amount of work that has been done in regard to asepsis and antisepsis. I have personal knowledge of Frederick Lange, formerly of New York, preaching antisepsis. He introduced it into Bellevue Hospital, and I think he was one of its strongest advocates. I do not know whether he antedated Gerster or not, but I do know that in 1880 Frederick Lange taught and practised it very extensively.

Dr. Francis Reder, St. Louis, Missouri.—I always feel attached to one who has had training under Dr. Gerster. It was my lot in 1886, 1887 and part of 1888 to be under Dr. Gerster's tutorage at the German Hospital, New York. It was at the time when antiseptic surgery was being recognized in this country and when some of the hospitals began to appreciate the value and merits of this procedure. I can, in a way, sympathize with Dr. Leigh, as I can readily appreciate his situation. During my service with Dr. Gerster, I thought I was being handled rather severely, but in later years I felt exceedingly grateful for this severe treatment, which I deserved, and which proved so helpful to me.

As Dr. Boldt has remarked, in association with Dr. Gerster at that time was Dr. Frederick Lange, who was possibly a little more severe than Dr. Gerster. It was sometimes a difficult matter to do things right, but, nevertheless, it was a great privilege to work and be taught by these two master surgeons.

Gloves were not known at that time. Our brushes were of "excelsior." The instruments were placed in a carbolic acid solution. We wore rubber aprons and wooden shoes. We operated in rooms which were flooded with a bichloride of mercury solution. We wore no mask or head covering. Nevertheless, when I look back at the results obtained in cases of abdominal section, hernia operations, joint resections and breast amputations they were simply marvelous. I am glad Dr. Leigh has prefaced his paper with such a beautiful story of a great surgeon.

TRAUMATIC BRAIN LESIONS

By E. Dunbar Newell, M.D.
Chattanooga, Tenn.

This paper will be confined to acute traumatic brain lesions and more especially to injuries occurring in civil state.

We have treated in out hospital during the past five years 68 cases of serious brain injuries that we have tabulated. We have not included all the brain injuries that we have received into the hospital, as some were moribund when brought in and died within a few hours and some were never serious, but we have included all the cases that were operated on, and some of these were deeply unconscious and greviously ill at the time of operation. The cases not operated on were usually the cases with linear fractures or no fracture, intracranial pressure not high, either not unconscious or only moderately so, and no focal symptoms of localized hemorrhage and no depressed fractures—the class of cases that without complication and without other injuries should recover.

There were 45 cases operated upon—subtemporal decompressions with 14 deaths (31 per cent mortality). These were the most serious cases of the series.

There were 19 cases not operated upon and 5 deaths (26 per cent mortality): 3 of these deaths occurred suddenly and were unexpected; 2 were treated by repeated spinal punctures to relieve the increased intracranial pressure—both recovered.

Including all severe cases of brain injuries, those operated on and those not operated on, the mortality was 28 per cent.

Fred Besley, of Chicago, in a report published in 1916 of the Cook County Hospital, regarding 1000 consecutive patients having fracture of the skull, states that the mortality was 53 per cent. This is about the mortality where large numbers of consecutive cases are reported.

During the last few years William Sharpe, of New York, has revolutionized the treatment of brain lesions and has greatly reduced the mortality of basal fractures by an early subtemporal decompression operation, and to him we owe most of our inspiration for the work that we have done in this field of surgery. The mortality percentage following operation may be very misleading and untrustworthy, as the class of cases selected for operation and the condition of the patient when operation is performed can and do fluctuate the mortality rate between 10 per cent and 90 per cent. By a most thorough and diligent and intelligent study of each case, from the infliction of the trauma to the brain until the patient is convalescing or is moribund, we can greatly reduce both the mortality and the morbidity of these serious brain injuries.

The mortality in serious basal fractures with high intracranial pressure, where operation is not done during the stage of shock and is done before marked medullary compression occurs, may be reduced from the usual 50 per cent to 80 per cent mortality to a 20 per cent or lower mortality. The post-traumatic neuroses, the oft-recurring headaches, the mental instability and irritability, the neurotic and the epileptic, can often be prevented or mitigated by the prompt diagnosis of a brain lesion where none is suspected, and the prompt application of measures to lower the blood-pressure and prevent or reduce an increase of intracranial pressure, or a prompt subtemporal decompression to relieve an already high intracranial pressure.

The patient who has received a blow on the head may or

may not have been temporarily unconscious; probably has a throbbing headache; may not remember how he was hurt; may be drowsy or very restless and wakeful; his temperature is usually normal; pulse about normal; blood-pressure normal or slightly raised; pupils may be normal or unequal in size and the reactions to light and to accommodation may be normal or subnormal; the ophthalmoscopical examination may be normal or the retinal veins may be dilated, and the stereoscopical roentgen-ray examination of the head may or may not show a fracture of the vault. This patient should not be operated upon—no operation is indicated and would do harm—but should be confined strictly to bed, kept quiet, ice-bag to head, free catharsis, given a low-protein diet and a minimum amount of fluids, and if he does not quickly respond to this treatment do a spinal puncture and withdraw from 10 to 20 cc of spinal fluid and repeat in twelve to twenty-four hours as indicated. Under this plan of treatment the blood-pressure and the intracranial pressure are lowered, the patient quickly relieved of headache and becomes entirely rational and comfortable. If this treatment is continued for seven to fourteen days, varying with the severity of the injury or the early return to normal, these patients will suffer little or not at all from that disagreeable train of symptoms called post-traumatic neurosis.

Where a blow on the head has been severe enough to cause fracture of the skull, or to cause even temporary unconsciousness, this is direct evidence that the brain or its membranes have been injured, and this requires watchful care to prevent possible serious complications.

July 14, 1922, J. W., male, aged twelve years, white, was struck by auto crossing Market Street bridge; was knocked down, becoming unconscious immediately; brought to the hospital in one hour.

Examination. Completely unconscious. Pulse, 80. Temperature, 99°. No visible sign of head injury except a

brush wound over left temporal region. Many brush wounds over body. Roentgen ray showed suture line greatly separated, due to intracranial pressure. Fracture line extended on right side 6 cm. from mastoid process, backward and upward for $3\frac{1}{2}$ cm.

Treatment. Put to bed and observed. Blood-pressure: Systolic, 110; diastolic, 65. Right pupil dilated. Remained unconscious for two days; semiconscious the following two days and rational the fifth day; improved steadily from then on. Patient had convergent strabismus. His people claim that this is due to injury.

July 28, 1922 (fourteen days), patient discharged from hospital in excellent condition except for derangement of eyes. Seen in one month: Condition had steadily improved; no complications.

June 9, 1922, Baby G. V., white, male, aged eighteen months, fell down steps, injuring head. Brought to hospital in unconscious condition. Hemiplegia of left side of body, including left side of face. Paralysis spastic with paroxymal convulsion, the latter beginning in about two hours after the injury. Temperature, $100\frac{4}{5}°$. Pulse, 140. Roentgen ray showed fracture 6 cm. long at right angle to the occipito-parietal suture line, right side, about 6 cm. from back of head.

Treatment. Child prepared for operation, but before he was taken to operating room the convulsive seizures and twitchings ceased on left side and patient moved left arm and leg a little. When irritated he appeared partially conscious and eyes were normal. Operation, of course, postponed. By 5 P.M., four hours later, patient was conscious.

June 10, 1922, next morning, paralysis was found to have decreased. Continued an uninterrupted recovery until June 20, 1922, when discharged. Was found to be normal in every way.

June 14, 1922, D. M., white, female, aged eight years, fell from porch, about thirty feet, to pavement, receiving blow on head.

Diagnosis. Fracture of skull; injury to right wrist, and hemorrhage from bladder.

Subjective and Objective Symptoms. Patient brought to hospital five minutes after injury, deeply unconscious. Pulse, 120. Blood-pressure: Systolic, 108; diastolic, 72. Temperature, 98°. Right pupil slightly dilated. Contusion about the size of turkey egg over right frontal and extending into temporal region. There was no paralysis. Color good. Respirations normal. Roentgen ray shows fracture of frontal bone on level with supraorbital ridge about 2 cm. back from it, the fracture line running upward and backward for 1½ cm.

Treatment. Patient moved as little as possible, especially head, while roentgen rays were being taken. Put to bed with dressings put on contusions and with ice-cap to right eye and frontal region. Room darkened, company kept out and everything possible done to keep child quiet.

Progress. Involuntary kidney action in four hours; urine normal in appearance; four hours later, urine bloody; continued so for three or four hours; 5 cc. thromboplastin given with good result. Next morning great improvement was noted: Child would ask for her mother, for water, etc.; was very irritable and restless. Ran temperature of 100° to 101° for two days after injury.

June 23, 1922, discharged. Blood-pressure: Systolic, 106; diastolic, 66; pulse, 78. Temperature, 98°. Patient perfectly normal, not the least irritable or restless and laughs and talks as before the injury. Pupils normal. Condition excellent.

In depressed fractures of the vault an operation is always indicated unless the patient is in severe shock. When in severe shock, never operate. The patient will surely die

if any operation is done to repair a fractured skull, to control hemorrhage from the brain, or to relieve intracranial pressure while the patient is still in a state of severe shock. As soon as the patient has overcome the condition of shock —as indicated by slowing of the pulse-rate, increase of the blood-pressure, rise of temperature, and return of blood to face and extremities—then the operation can be done with apparent safety. Where the patient has slowly developed unconsciousness following a blow on the head, or where we have distinct symptoms of cortical focal hemorrhage, if there is no shock, then an operation should be done at once, even without an increase of intracranial pressure.

Because the roentgen ray shows a fracture or fractures of the vault alone, or of the vault and extending to the base, is not *per se* an indication for operation. You operate to relieve a depressed fracture or to control hemorrhage or to relieve an increase of intracranial pressure.

Every case of head injury where the blow has been sufficient to cause a fracture should have stereoscopical roentgen-ray pictures made. The roentgen ray may not show the fracture line running into the base, but the fact that we have a fracture running toward the base is strong evidence that we have a fracture of the base too. A fractured skull, even if it be only a slight crack, should be handled with wholesome respect and watchful care, not on account of the injury to the skull—that is unimportant—but because the fracture indicates that there has been trauma of greater or less degree to the brain and its membranes. Personally, we rarely have had to operate for hemorrhage of the middle meningeal artery or its branches unassociated with depressed or extensive fracture of the vault. At one time this was thought to be a rather common occurrence.

The most urgent reason to operate for traumatic brain lesions is to relieve the increased intracranial pressure. We may not have an increase of intracranial pressure even with a fracture of both vault and base, and in the absence

of a depressed fracture or of localized hemorrhage no operation is indicated if there is no marked increase of intracranial pressure. But even without a fracture or a crack of either vault or base, if there is a marked increase of intracranial pressure, then an operation is imperatively demanded to relieve this intracranial pressure.

If there is a condition of grave shock, even with the most acute high intracranial pressure, an operation is not indicated until the shock has been overcome by rest, warmth and morphine. Operation is useless in this condition, as the additional trauma of the operation surely means death. Even without shock, if the patient has passed to the stage of medullary edema and collapse—as evidenced by rising temperature, rapid pulse and rapid respiration, of 120 plus and 40 plus respectively, deep unconsciousness and loss of both superficial and deep reflexes—then operation is usually useless, as it is nearly always followed by death, but an operation may still give the patient a chance.

Some patients never overcome the shock and die in shock. Some pass quickly from the condition of shock to that of medullary collapse and edema of the brain. The pulse-rate is never lowered below 110 to 120; respiration ranges around 40; the patient is deeply unconscious, and both superficial and deep reflexes are usually absent. Then no operation is indicated, as the patient will surely die and an operation will only hasten the end. Operation is rarely indicated for paralysis of the extremities in the absence of high intracranial pressure. These paralyses are usually due to punctate cortical hemorrhages and to laceration and contusion of the brain. If the exudate is not sufficient to cause a marked increase of intracranial pressure it will be absorbed under the expectant pallative treatment and the paralysis soon disappears, unless there has been extensive laceration of the cortex, and then usually we have symptoms of high intracranial pressure. Convulsive seizures without high intracranial pressure are usually best treated

by the expectant, palliative method; but if the seizures continue, do a lumbar puncture and withdraw from 10 to 20 cc of fluid, and repeat in twelve to twenty-four hours if the symptoms are not relieved. The headaches and restlessness of a mild increase of intracranial pressure are often quickly relieved by drawing off 10 to 25 cc of spinal fluid. Withdrawing this fluid properly, and not more than 2 cc for examination, will never cause inconvenience or death when aseptically done, even when the intracranial pressure is high; but it can become a dangerous procedure, as the withdrawal of more than 5 cc of fluid might cause the sudden dropping of the medulla into the foramen magnum and thus cause compression of the medulla and sudden death.

January 26, 1922, E. B., colored, male, aged forty-eight years, was struck on the head by large lump of coal. He said that he was unconscious for several hours. Was conscious when seen at his home the morning after injury. Complaint was, "severe headache."

Symptoms After Being Brought to the Hospital. Delirious; headache was most severe; nausea; dizziness; pulse, 54. Blood-pressure: Systolic, 128; diastolic, 86. Temperature, 98°. There was a contused, lacerated, infected wound over the posterior termination of the sagittal suture. Roentgen ray showed "suspected" fracture of inner table near occipito-parietal suture.

January 27, 1922, spinal puncture was done between the third and fourth lumbar vertebræ. Fluid came out readily, but did not seem to be under great pressure. Mercury manometer registered 20 mm.; 10 cc fluid withdrawn. Clear, no blood. Great improvement followed, especially relief from headaches.

January 28, 1922. Lumbar puncture; fluid clear. Mercury manometer registered 10 mm., 15 cc withdrawn.

February 27, 1922, discharged in fine condition, able to do light duty.

March 12, 1922, F. W., white, male, aged twenty-four years, was brought into hospital. Patient was not able to give history of accident; semiconscious, very restless. Blood-pressure: Systolic, 130; diastolic, 80. Pulse, 72. Respiration, 20. Pupils react sluggishly to light.

Ophthalmoscope Examination. Right eye disk indistinct and slightly swollen. Left eye, nasal half of disk hazy.

Roentgen-ray Examination. Fracture through the right side of the occipital bone; line starting about 1½ inches down from parieto-occipital suture and running upward and forward for 2 inches into parietal.

March 16, 1922. Patient still unconscious. His pupils reacted sluggishly to light. Abdominal reflexes normal. Unable to obtain positive knee-jerk.

March 15, 1922. Lumar punctures made, spinal fluid pressure found to be 20 mm. of mercury. 20 cc of bloody fluid drawn off. Patient appears to be less restless since puncture. Negative Babinski. Blood-pressure: Systolic, 130; diastolic, 75.

March 17, 1922. Spinal puncture repeated and 20 cc fluid withdrawn.

March 18, 1922. Patient conscious this date, but still sleeps practically all the time.

March 20, 1922. Patient conscious; able to recognize his friends. Blood-pressure: Systolic, 110; diastolic, 80.

March 21, 1922. Patient still sleeps, but can be aroused very easily; does not remember anything about accident; states that he is twenty-four years old. Blood-pressure: Systolic, 105; diastolic, 70. Pulse, 68.

If a patient has been observed from the time of the trauma to head through the usual six to twelve hours of shock and the record shows that the pulse has been lowered from 110 to 130 down to 70 to 80, the respiration lowered from 30 to 40 down to 12 to 24, the blood-pressure raised from 100 to 110 up to 120 to 150, the temperature raised from sub-

normal to above normal, the ophthalmoscopical examination of the fundi shows marked dilation of the retinal veins, the spinal mercurial manometer registers a cerebrospinal pressure of 16 mm., we know that our patient has reached the stage of medullary compression and that there is decided increase of intracranial pressure. This patient should be examined hourly, and if the symptoms of intracranial pressure become more marked—as evidenced by a greater lowering of pulse-rate and respiration, a decided edematous blurring of the nasal half of the optic disk, an increase of blood-pressure and a raise of the cerebrospinal pressure—then a subtemporal decompression operation should be done at once and a rubber-dam drain inserted into the middle fossa.

During the past three weeks I saw a vigorous boy, sixteen years of age, who had, three hours previously, a severe blow to his head. He was deeply unconscious; there was total absence of superficial reflexes, but he had a marked Babinski of the right great toe; pulse-rate, 88, full and strong; respiration, 24; extremities and face not blanched and cold, but face was somewhat cyanosed; stereoscopic roentgen-ray pictures absolutely negative for fracture, although there was a deep flesh wound above right ear that exposed the bone; lumbar puncture drew blood-stained spinal fluid and the spinal mercurial manometer registered a pressure of 16 to 18 mm.; systolic blood-pressure was 145. These symptoms indicated high intracranial pressure, not shock.

A subtemporal decompression operation was done at once and the incision so located as to go through the lacerated wound made by the blow. No fracture was found; in fact, not even a crack of the inner table. There was no extradural bleeding and very little subdural hemorrhage, but the brain was edematous and under great pressure, and bulged through the bony opening as soon as the dura was freely

opened over an area of about 2 inches in diameter and left open. There were numerous minute lacerations of the cortex, and through one of these lacerations brain tissue quickly began to exude. Rubber-dam drain inserted into the middle fossa and both drains brought out at the lower angle of the wound. The fascia and temporal muscle were closed over the bony defect with catgut, and the skin closed with interrupted silkworm gut. The patient stood the operation well and was returned to his room in about the same condition as before operation. However, soon after operation the temperature began to rise, and eleven hours after operation was $109\frac{1}{5}°$. Death in twelve hours after the operation. A subtemporal decompression gave the only chance, but we fully realized that even this was but a faint hope.

Hemorrhages from the ears, nose and mouth, and subconjunctival ecchymosis and ecchymosis over the mastoid, are frequently considered as positive signs of basal fracture. But this is not true. Hemorrhage from the ear is strong presumptive evidence of a basal fracture, but the hemorrhage may come from a ruptured drum or a tear of the periosteum without a fracture; hemorrhages from nose and mouth may be present without a fracture; ecchymosis around the eye may be due to trauma of the soft tissues and not due to a fracture. But certainly subconjunctival ecchymosis without any evident injury to the soft tissues adjacent to the eye points impressively to basal fracture, and especially so if the ecchymosis appears two or three days after the injury. The presence of cerebrospinal fluid with the blood exuding from ear, mouth or nose is positive evidence of a basal fracture.

If this high intracranial pressure is not relieved early, edema of the brain will develop, the pulse-rate will rise rapidly, with irregular, fast respiration and medullary

edema occurs, and then the patient will die with or without an operation. If the patient is seen for the first time with a pulse-rate of 50 to 60, respiration of 16 to 24, marked edema of the optic disks, and the spinal mercurial manometer indicates a pressure of 16 to 30, then operate at once. A continuation of high intracranial pressure causes marked edema of the brain and medullary collapse may intervene at any hour; then it is too late for surgical aid. Edema of the brain is most probably caused by an increased secretion of cerebrospinal fluid from the choroid plexus of the veins of the third ventricle, by deficient absorption of the cerebrospinal fluid, by the blocking of the cortical veins and sinuses and by the exudation of serum from the dilated intracranial bloodvessels. This high intracranial pressure, if prolonged, causes an increase of neuroglial cells or neural connective tissue, and thus we may have a pathological explanation of that great, dread of all railroad claim-agents and railroad lawyers, "posttraumatic neurosis," superimposed upon an organic basis on these special cases.

Conclusions. A stereoscopical roentgen-ray picture should be taken of every head injury where the blow has been sufficient to cause a fracture of the skull or to render the patient unconscious.

Fracture of the skull, *per se*, does not indicate that the patient has been seriously injured. With the symptoms of lesion of the brain or its membranes present, the absence of a fracture does not alter in the least the treatment or the prognosis.

Because the roentgen ray does not show a fracture of the base, does not mean that one does not exist.

Basal fractures must not be considered hopeless cases. Certainly 75 per cent may be saved, if they are watched intently and intelligently treated *early* and not operated upon only when the patient "looks as if he was going to die."

DISCUSSION

Dr. Urban Maes, New Orleans, La.—Those of us who are interested in traumatic brain lesions will thank Dr. Newell for bringing this subject before the Association.

I believe we can do a great deal if we take care of these patients in the proper way. It strikes me that certain rules should be followed in the treatment of extensive cranial injuries that involve the brain. In the first place, we should classify these injuries and lesions under two distinct heads: First, fractures of the vault and fractures of the base; second, those fractures of the vault with brain injuries, and fractures of the base with brain injury, and both of these without brain injury. With this classification we can simplify the treatment.

Dr. Newell mentioned the use of the spinal manometer. I believe we have in it a real aid which we should utilize. As to the indications for operation in injuries involving the brain, the spinal manometer will give us positive indications as to when these cases should be treated by decompression. If these patients are not carefully observed as regards shock, and if they are operated on in shock, particularly those injuries involving the base of the skull, we are going to have a high mortality unless a proper lapse of time and proper treatment are administered. The rule of waiting for a set number of hours, say six or eight, and observing the degree of shock during this time, and then taking readings with the spinal manometer, we can get the indications for decompression. If a decompression cannot be conveniently done, we should resort to spinal puncture as a means of relieving intracranial tension.

The important points in all brain injuries are the observation and treatment of shock, accuracy of diagnosis and the spinal manometer readings, showing the increase in intracranial tension. If after some time the patient recovers from shock, we can relieve the tension by a decompression. We should not attempt to modify the typical operation of Cushing.

Dr. John Wesley Long, Greensboro, N. C.—I would like to make a few remarks on Dr. Newell's paper and in connection therewith show some slides of traumatic brain lesions.

The first case I want to call attention to is a brain injury from a pistol-shot wound in which a boy was shot in the forehead and the bullet lodged almost exactly in the middle of the brain. He was knocked down, rendered unconscious, and when brought in was badly shocked. The first slide shows a side view, and

the second one an anteroposterior view. These pictures were taken in January, 1914. Several years later the third picture was taken and shows the bullet still in the middle of the brain. It has been nine years now since the bullet entered the boy's brain, yet he has grown to manhood and has had no inconvenience whatever from the presence of the bullet.

This next patient was also shot in the forehead. The bullet entered on the left side and you can see it lodged in the right hemisphere. I saw this patient eight days after the injury. He was having general convulsions, also had paralysis on the left side. I operated on him and he recovered. The next slide is a lateral view of the same case. You can see where the skull was fractured and the bullet lodged.

The third case is that of a five-year-old boy who was shot in the forehead. He was brought in profoundly shocked. The slide shows the bullet in the posterior fossa of the brain or skull. He was paralyzed for three to five days. He was operated on and recovered.

The fourth case is that of a man with a fracture of the posterior portion of the skull, who gradually became comatose, and was operated on eight days after I saw him. You see the fracture running along near the occipito-parietal suture. We found an organized blood-clot that was two inches in diameter and one-quarter of an inch thick. When he woke up from the anesthetic he said that it was the first time he had been conscious for eight days.

Here is a slide of a boy who struck the side of his head in the temporal region against a spinning frame in a cotton mill. He worked the rest of the day. He gradually developed serious symptoms. When brought to me two weeks after the injury I found an abscess had formed inside the cranium and had perforated the skull. It was one of the unusual cases of perforated skull from a brain abscess. When I cut down into the temporal region there was an opening in the skull the size of a lead-pencil, which I enlarged. There was an abscess an inch and a half in diameter and enclosed in a sac which was extruded through the enlarged opening by the force of the intracranial pressure. This boy in later years developed epilepsy, but is able to earn his living in the cotton mill.

Dr. Francis Reder, St. Louis, Mo.—Will Dr. Newell kindly give us his views on the prognosis of these cases and his conclusions?

Dr. Newell (closing).—In my paper I excluded brain injuries encountered in military surgery because that is an entirely different field. I did not include injuries due to missiles for the same reason. I tried to bring out the fact that treatment consisted in watching these cases carefully and in making a proper diagnosis. The principal thing to find out first is whether you have an extensive depressed fracture. If you have a depressed fracture it demands operation. As soon as shock is over you must operate. That does not admit of any discussion. When you have extradural hemorrhage it is a simple matter to diagnose these cases, and there is no excuse for a patient dying of extradural hemorrhage if you watch him carefully. These cases should be operated on, but the only question is, as Dr. Maes said, "Do not operate when the patient is in shock." He gave some indications for the increase of intracranial pressure. You cannot find them out unless you study the case carefully and closely.

The spinal manometer always gives us valuable evidence. I have been using it for many years, and while it is a valuable aid, sometimes it is of little or no importance. We believe that blood-pressure is important. We also believe that the pulse-rate is important in these cases. Ophthalmoscopic examination is of very great importance and is a great aid. If you have partial increase of intracranial pressure you will have dilatation of the vein. Any good man can use the ophthalmoscope and can do it in these cases, and it will materially aid him.

So far as dilatation of the pupils is concerned, we do not find it of so much importance. We do not find that a dilated or contracted pupil helps very much. With a serious injury you may have no dilatation of the pupil. The most important sign is increased intracranial tension as determined by the reading of the spinal mercury manometer, and you cannot go far wrong if you read it. The patient should be carefully watched. A most important point is to keep the patient absolutely quiet. We have had one or two patients that we thought were dying, but their injuries were not mortal. In handling these cases it should be done quietly and be careful in moving them around and study them from beginning to end. Do not move the head roughly as it may cause sudden collapse and death.

BRAIN ABSCESS: WITH ESPECIAL REFERENCE TO ABSCESS OF THE FRONTAL LOBE

By Harry Hyland Kerr, M.D., C.M.

General Considerations. Abscess of the brain is a focal suppurative encephalitis of the cerebral or cerebellar tissues. It may be single or multiple, and any of the pus-producing organisms may be the exciting cause. The condition is always secondary to suppuration elsewhere. While it most commonly follows infection of the ear or sinuses, it may arise from chronic infection elsewhere in the body. When an abscess is secondary to an acute condition, the primary infection is always in the immediate neighborhood. Brain abscess may follow traumatism of the head, as perforating fracture of the skull or gunshot injuries. The traumatic type will not be considered in this communication.

The condition is usually seen in adults, but may occur at any age. According to Holt, brain abscess is rare in very young children. Suppuration in the ear or mastoid is by far the most common cause of abscess of the temporo-sphenoidal or cerebellar lobe. Frontal lobe abscess usually arises from infection of the frontal or ethmoid sinuses.

Although the following discussion includes brain abscess in general, because of certain difficulties which are encountered in the diagnosis of frontal lobe abscess, particular attention is devoted to involvement of this area. It is generally conceded that abscess of the frontal lobe is rela-

tively rare. In his recent book, *Brain Abscess*, Eagleton gives an exhaustive review of the published cases, with a bibliography thereof. He found that not more than 150 cases of what he called adjacent frontal lobe abscess (abscess by direct infection) have been reported, while more than 900 cases of adjacent abscess of the middle cerebral fossa were found by him in the literature. Of these 150 cases, he analyzed 118.

We have analyzed 113 of these cases and find that 44 per cent, or nearly half of them, were not recognized until autopsy. It is evident there is need of careful study of all cases in the hope of improving the diagnosis of frontal lobe abscess. This study includes 6 original cases.

Again, we find that we have an extremely high mortality, 75 per cent. As the mortality is much higher in the cases operated upon late, that is, in the terminal stage, the need of earlier diagnosis so that they may be attacked during the latent or more hopeful period is emphasized.

Pathology. On the invasion of the brain tissue with microörganisms, a localized encephalitis is produced. The infection may reach the cranial contents by direct extension, as from an infected middle ear (adjacent abscess of Eagleton's classification) or by septic emboli from a distant chronic process (metastatic abscess). Direct invasion may occur through an infected phlebitis of the tributary veins of the thrombosed blood sinus or by osteomyelitis, localized meningitis and encephalitis. At the onset the process is what used to be called "acute softening of the brain." The condition may progress with rapidly advancing symptoms and eventual death. On the other hand, when the local encephalitis has completely broken down, a pyogenic membrane may be produced which encapsulates the pus for a longer or shorter time (encapsulated abscess). In this way, a quiescent stage is produced, lasting over many months or even years. Eventually, however, one of two things occur: The abscess ruptures or a secondary ence-

phalitic process starts, progressing rapidly to a fatal issue. Rupture of a brain abscess may occur when the presence of an abscess is not suspected, the resulting condition suggesting a vascular lesion. For anatomical reasons, and because of its being a so-called "silent area," the frontal lobe is peculiarily susceptible to this state of affairs. This is illustrated in the following case:

Case I.—A. G., female, aged twenty-three years. First seen, December 8, 1921, in consultation with Dr. Hough and Dr. Burns. Had suffered from headache for the past two years, more severe during the last three months. Three weeks before consultation she had fainted in her office, and since then had not returned to work. She spent some days in bed, on others she was up and around. Two days before consultation she went on a street-car to have a roentgen-ray examination of the head made, at the suggestion of Dr. Gill. This showed involvement of the left frontal sinus and antrum. On December 7, the patient had a convulsion in the morning, a second at noon and a third at night. A spinal puncture was made by Dr. Hough about midnight, 20 to 25 cc of bloody fluid being withdrawn very slowly and intermittently. This was followed immediately by unconsciousness and apnea. Artificial respirations were started and kept up until 4 A.M., when I first saw the patient.

The left ventricle was tapped from above and a few cubic centimeters of bloody fluid spurted out under great pressure. Tapping of the right ventricle was negative. With artificial respiration continued, the patient was transferred to Garfield Hospital, in an ambulance, where a left subtemporal decompression was performed under local anesthesia. The brain was found under great pressure, white, non-pulsating and there was no bleeding from the cortical vessels. A right subtemporal decompression was immediately performed, with similar findings. Following the last operation, the cortical vessels bled freely and the brain

became more pink. An intratracheal tube was introduced and attached to a positive pressure motor with the air driven in at a pressure of about 10 to 15 mm. mercury. Cyanosis and impaired heart action came on gradually, so that rhythmic pressure over the chest had to be done in addition. Spontaneous respiration was never established. Cardiac action grew gradually weaker until death occurred at 11.30 P.M., twenty-three and a half hours later.

Autopsy showed a small abscess, about the size of a walnut, under the anterior horn of the right ventricle, the abscess having ruptured, with hemorrhage into the ventricle; both the lateral ventricles, especially the right, and the third and fourth ventricles, were found filled with recent clot. Some small scattered clots were found in the subarachnoid space around the base. The tip of the cerebellum on the right side showed a rim-like depression, as though it had herniated into the foramen magnum.

Symptoms. The symptoms of brain abscess are general and focal.

The general symptoms are those of an infection plus increased intracranial pressure. The chief complaint is headache. There may be vomiting, convulsions or stupor. Temperature in the latent stage may be normal or subnormal; when increased, it varies in degree according to the acuteness of the condition. Leukocytosis, usually of low grade, is common, but this, also, is occasionally wanting in the latent stage. As the process destroys the brain tissue rather than displaces it, pressure symptoms are usually inconspicuous.

Cerebellar Abscess. When the cerebellum, the second most frequent site of abscess of otitic origin, is involved, one finds nystagmus, adiadokokinesia, positive Rhomberg, positive Barony and respiratory difficulties.

Cerebral Abscess. When the process occurs in the *temporo-sphenoidal lobe*, secondary to otitic infection, the following symptom-complex is seen: Abscess is the *right* temporo-

sphenoidal lobe, in right-handed individuals, produces transient weakness of the lower left face, diminished left abdominal and cremasteric reflexes, increased left deep reflexes and a left Babinski. Abscess in the *left* temporo-sphenoidal lobe in right-handed individuals gives rise to the above phenomena, plus sensory aphasia, difficulty in naming objects seen and recognized and word forgetfulness. A careful mapping of the visual fields shows the existence of an incomplete hemianopsia.

When the *motor area* is involved, Jacksonian convulsions, followed by paresis or paralysis, points to the focus.

In *occipital lobe* lesions, subjective or objective eye symptoms appear.

When the *frontal lobe,* the so-called "silent area," is affected, focal symptoms may be entirely lacking. Diagnosis in this region is most difficult because there are no characteristic focal signs of frontal lobe involvement for the chronic cases and the signs in the acute cases differ very slightly from those of the causative neighborhood lesion.

In the cases reviewed by Eagleton, clinical evidence of intellectual and psychic disturbances were generally found wanting. Change of disposition and poor memory, according to this author, may be present, although they have been but infrequently observed. Mental dulness, stupor and coma may occur. Mental dulness and stupor were noted in 4 of my 6 cases. Headache was almost a constant symptom. Of the 6 cases, in 1 (Case III) no record was made of this symptom. The patient was admitted for cerebral hernia following gunshot wound of the head. The hernia was caused by the pressure produced from a frontal lobe abscess. The decompression manifested by the hernia explained the absence of headache. It was a pronounced feature of the other 5 cases. Convulsions occurred in 3 cases. There was evidence of increased intracranial pressure on fundus examination in all the cases; in 4 there was a frank choked disk. This is contrary to the views expressed

by Eagleton, who states, "In frontal lobe abscess papill-edema is rarely present."

The accompanying table gives the chief symptoms noted in the 6 cases.

Diagnosis. In the early and acute stage the diagnosis must rest upon the evidence of intracranial involvement of a neighborhood infection and the elimination of other possible localization. Certain objective signs may be of great importance; indeed, the localization of the lesion may rest on this entirely. In Case II, Macewen's sign of altered percussion note and tenderness was the only positive sign of a right frontal lobe abscess.

Case II.—A. K., male, aged fifteen years, referred by Dr. Campbell and Dr. Hough, December 11, 1921. At five years of age the patient had an acute otitis media on the left side, followed by persistent foul discharge. About two years before admission there was some disturbance of the left eye, for the relief of which a submucous resection of the nasal septum was performed. Two months later cerebrospinal rhinorrhea developed. This persisted unchanged for twenty months. Two months before admission the rhinorrhea suddenly ceased and Pneumococcus meningitis developed. He recovered, following repeated spinal punctures. Two weeks before I saw him, headache and vomiting began. On examination he showed slight elevation of temperature, 16,000 leukocytes and a beginning choked disk. Neurological examination was absolutely negative. Percussion, however, brought tenderness over the right frontal region, with decided change in the percussion note. Roentgen-ray examination showed nothing except increased intracranial pressure. The question of internal hydrocephalus following meningitis was considered, but the local tenderness and changed percussion note pointed to a right frontal brain abscess. Craniotomy in this region was performed.

Several ounces of greenish pus (pure culture pneumococcus Type IV) were evacuated from an abscess, about 3 cm. deep, in the right frontal lobe. Drainage was maintained for six months and was followed by complete recovery.

With the history of chronic infection, especially of the middle ear or head sinuses, and of headache, choked disk, mild temperature and leukocytosis, plus the focal symptoms outlined above, the diagnosis of brain abscess, with the possible exception of abscess of the frontal lobe, can be made sufficiently early for surgical intervention to give a fair chance of recovery.

Because of the more or less complete absence of focal symptoms, abscess of the frontal lobe is apt to be overlooked until too late for surgical interference to save the life of the patient. The presence of infection of the frontal sinuses, of the ethmoid or orbit should place one on guard with respect to the possibility of abscess of the frontal lobe. Persistent frontal headache in the presence of such infection, well-drained, points directly to involvement of the frontal lobe. The other symptoms enumerated, together with a suggestive history, leaves little doubt as to the diagnosis. In view of the small size of the area concerned in frontal lobe abscess and the consequent possibility of rupture before the abscess has attained sufficient size to give rise to the symptoms which otherwise would be manifest, suspected cases should be studied closely and operation performed before rupture occurs.

Differential Diagnosis. Brain abscess must be differentiated from generalized encephalitis, meningitis and sinus thrombosis. Lumbar puncture carefully performed is an aid in the differentiation. A high cell count, especially of leukocytes, points to meningitis. A slight increase in cells, especially lymphocytes, points to encephalitis. Percussion of the skull may elicit a higher-pitched note and tenderness as an aid to the diagnosis and localization.

Treatment. The treatment of brain abscess, of course, is surgical. "When pus is located, open and drain." The surgical principles are the same as for pus elsewhere in the body, but the means of evacuation and the after-treatment are very different.

Exploratory Craniotomy. The diagnosis of brain abscess depends upon a preponderance of either the general or focal symptoms. If the focal symptoms are only suggestive or even wanting an exploratory craniotomy may be indicated. Exploration should be made with the brain needle. A small trephine craniotomy under local anesthesia exposes the dura and permits the insertion of an exploratory needle in several directions to a depth of 6 or 7 cm. A blunt hollow needle made with a stylet and with several openings on the side should be used. As the pus may be under slight pressure, the needle should be inserted slowly and allowed to remain long enough in each suspected area to allow a possible thick pus to find its way out. In chronic abscess it will be necessary to force the needle through the pyogenic membrane. With the use of more than one brain needle, the exact location of the abscess can be determined.

If the abscess is in the neighborhood of a local bony infection, as mastoiditis or frontal osteomyelitis, the question of exploration through the infected area or through a sterile field is to be decided. Each method presents its disadvantages. Exploration through an infected field may carry organisms into a sterile subarachnoid space, thus initiating a fatal meningitis. On the other hand, a positive finding made through a sterile exposure may carry infection from the abscess into a sterile subarachnoid space, with resultant meningitis, though this is less likely.

The otologist is rather prone to explore through the infected wound. As a rule, the infection has reached the brain by direct extension, the underlying meninges have been agglutinated and there is little danger of spreading

the infection. There may even be encountered a subdural abscess, which, of course, is best attacked by this approach.

In exploring through a sterile field, the increased intracranial pressure will have temporarily obliterated the meningeal spaces. A few hours' packing outside the dura will produce sufficient adhesions to allow subsequent drainage without danger. This is illustrated by the following case:

Case III.—W. M., male, aged twenty-nine years, referred by Dr. Fritz Reuter, May 15, 1921. Cerebral hernia following a gunshot wound received two years ago. From the history and neurological examination, it was believed that an abscess was present in the neighborhood. An exploration through a sterile field located pus at a depth of 4 cm. The brain needle was withdrawn and the extradural space packed with gauze. On removing the packing, in twenty-four hours occlusion of the underlying meningeal spaces occurred, allowing a free opening for drainage. Prompt recovery ensued with a spontaneous cure of the cerebral hernia.

Local anesthesia is the anesthetic of choice.

In my opinion, an osteoplastic flap should very seldom be used to attack a brain abscess.

It is contrary to good surgical judgment to open widely the region most susceptible to infection—the subarachnoid space—to drain an abscess. If it cannot be reached through its own avenue of invasion, already occluded by a plastic meningitis, then a more accessible route should be produced. Packing may be placed outside the unopened dura over as large an area as may be desired and left for twenty-four hours or more. This will produce sufficient intradural reaction to set up aseptic occluding adhesions and prevent the inception of an acute meningitis when the abscess is drained at a subsequent sitting.

When the abscess is located with the brain needle either at the primary operation through the already occluded

meninges or at a secondary operation, the needle should never be withdrawn until ample drainage is established. A grooved director or similar instrument should be passed along the needle and the track gradually enlarged until a tube of sufficient caliber can be inserted.

In the chronic abscess with a firm membrane it is wise not to allow the cavity to empty itself through the searcher, for fear of collapse and difficulty of again finding it. I have never used the encephaloscope and feel that the additional trauma in its use is unnecessary.

With the increased pressure there is a tendency for a decompression through the craniotomy opening and extrusion of the drain. The type of drain used varies with different operators. Gauze packing, glass tubes, rubber tissue and rubber tubes all have their advocates. Tubes made of wire mesh were used in the British Army and have found favor in this country.

Two points must be emphasized: The need of preventing the extrusion of the tubes in the presence of pressure and prolonged drainage.

I have devised a tube which I have used for the past year with gratifying success. It is an ordinary rubber drainage tube with a rubber cuff fixed about 3 cm. from the end. The tube is split down to this cuff and to each half a tape is sewn. When the tube is in place the tapes are tied around the head and effectually prevent its extrusion.

Once the drain is properly placed it should not be disturbed. If withdrawn to be cleansed, there may be difficulty in replacing it, as its pathway may disappear within a few minutes, in the soft cerebral tissue. The drain may be kept open by applying a dressing soaked in glycerine, or a small rubber catheter may be inserted through the drain daily and aspiration practised. Irrigation is not indicated and is fraught with danger, but the instillation of dichloramine-T after aspiration, I believe, helps to overcome the infection.

TABLE OF CASES.—FRONTAL LOBE ABSCESS.

Number.	Name.	Age.	Source.	Organism.	Length of time elapsed between onset of causative lesion and first symptom of abscess.	Time between first symptom and first consultation.	Symptoms.	Complications.	Operation.	Postoperative course.
I.	A. G.	23 yrs.	Probably infected frontal sinus and antrum	Unknown	Unknown	Over 2 yrs.; chronic	Convulsions; headaches; fainting; spells of apnea following lumbar puncture	Rupture abscess into ventricular hemorrhage	Subtemporal decompression; bilateral	Died 24 hrs. later; autopsy.
II.	A. K.	16 yrs.	Cerebrospinal rhinorrhea	Pneumococcus	1½ yrs.	16 days; acute	Macewen's sign; right frontal headache; beginning choked disk; leukocytosis; vomiting; slight temperature; stuporous	None	Craniotomy; drainage, 6 mos.	Well.
III.	W. M.	29 yrs.	Gunshot wound of frontal lobe	Staphylococcus	Unknown; weeks	2 yrs.; chronic	Cerebral hernia; convulsions; choked disk; vomiting; slight temperature; fast pulse; left-sided paresis; no headache	Cerebral hernia	Craniotomy; drainage, 2 mos.	Well.
IV.	F. B. D.	17 yrs.	Ethmoiditis	Staphylococcus; streptococcus	15 days	5½ mos.; chronic	Convulsions; frontal headaches; choked disk; leukocytosis; slight temperature; mental dulness; diplopia; Macewen's sign, right frontal	Surgical shock	Right frontal osteoplastic flap	Died several hours after operation; autopsy.
V.	M. S.	10 yrs.	Infected nasopharynx	Unknown	2½ days	4 mos.;	Headache; aphasia; choked disk; projectile vomiting; slight temperature; leukocytosis	....	Craniotomy during terminal encephalitis	Died 24 hrs. later; no autopsy.
VI.	W. D.	28 yrs.	Frontal sinusitis and osteomyelitis of frontal bone	Streptococcus	7 mos.	Unknown days; acute	Leukocytosis; temperature; headache; right hemiplegia; convulsions; aphasia; drowsiness	Extradural abscess unrecognized	Exploratory craniotomy and drainage	Died 7 days after operation; autopsy.

No matter what form of drain is used it should not be disturbed until all symptoms have completely disappeared, and then only to shorten it very carefully. For this reason rubber tubing is advantageous. If the tube is cut off at no greater length than its diameter, there is no danger of pocket formation. The tube may thus be slowly shortened. I would urge that drainage be maintained for too long rather than for too short a time. There is no *vis a tergo* or muscular action and movement to help squeeze empty a pus pocket as in other soft tissues in the body, so that we must rely entirely upon the healing process to cure an abscess of the brain.

The table on page 473 summarizes the 6 cases of frontal lobe abscess upon which I have operated to date, including the 3 briefly recorded above.

Conclusions. 1. Brain abscess in general is difficult of diagnosis and especially difficult of treatment.

2. Abscess of the frontal lobe of the brain has been recognized before death in only about half of the reported cases.

3. The mortality points to the need of a more careful study of all such cases.

4. Persistent headache with sustained leukocytosis, and especially the presence of retinal changes indicative of pressure in cases of drained frontal sinusitis or ethmoiditis, demand exploration.

5. Exploration by the two-stage operation through a sterile field may be indicated.

6. Direct drainage with a minimum trauma should be established and not be disturbed until all symptoms have subsided.

7. It is of paramount importance to drain a brain abscess for too long rather than too short a time.

BRAIN ABSCESS: WITH PATHOLOGICAL OBSERVATIONS

(A Presentation of Lantern Slides)

By Charles Bagley, Jr., M.D.
Baltimore

The substance of these remarks is part of a study of 20 cases of brain abscess: 17 were operated on with a mortality of 47 per cent, 8 operated and 3 unoperated cases died and autopsies was performed in 8 of the 11 fatal cases. Points of interest are shown in the lantern slides.

These slides have been selected for the purpose of showing: (1) Some of the avenues of infection, particularly those through which the infection reaches the brain of tympanic cavity inflammation and of gunshot and traumatic injuries, and (2) behavior of the brain with regard to the formation of the abscess wall after the introduction of infection. Case reports are not attempted, but a few clinical facts are added, that the pathological illustrations will not lack the value of a clinical background. Initials of patients are given that the material here may be connected with the full clinical history of the patient, which it is planned to publish later.

The material illustrating avenues of infection has been arranged in four groups, some of which are subdivided.

Avenues of Infection

Group I. Presence of an extradural extension of the primary focus with:

(*a*) Protrusion of the distended dura into the cranial cavity.

(*b*) Direct extension from the extradural abscess.

(*c*) Invasion from the extradural abscess along the bloodvessels.

Group II. Secondary invasion of the brain along the bloodvessels without extradural link.

Group III. Penetrating brain injury with infection by foreign body, deep, with or without stalk.

(*a*) Path infected and open, hence long abscess stalk.

(*b*) Path healed, hence no abscess stalk.

Group IV. Abscess superficial and open, secondary to direct laceration and infection of brain tissue.

Group I. Presence of an Extradural Extension of the Primary Focus. In considering the extension of infection from the tympanic cavity and accessory nasal sinuses to the brain, the dura must be placed first in importance as a barrier. Osteomyelitis of the wall of any of the cavities adjacent to the dura is likely to result if thorough drainage of the pus is not accomplished within a reasonable time. Further extension of the inflammation is prevented when the process reaches the dura, which, because of its fibrous architecture, is capable of active proliferation. Because of this defensive reaction the inflammation is limited to the extradural space for a period of sufficient length to justify its designation as one of the stages of extension of infection from the primary abscess to the brain.

It is important that this stage be recognized clinically, because if the accumulation of pus is not evacuated early, further extension will almost certainly occur. In no specimen of our material has this extradural accumulation been large, though several specimens demonstrate its occurrence. Extension from the extradural abscess in this series occurred in three different ways, which have been arranged as subdivisions of Group I.

The abscess shown in Fig. 1, a drawing of the temporal

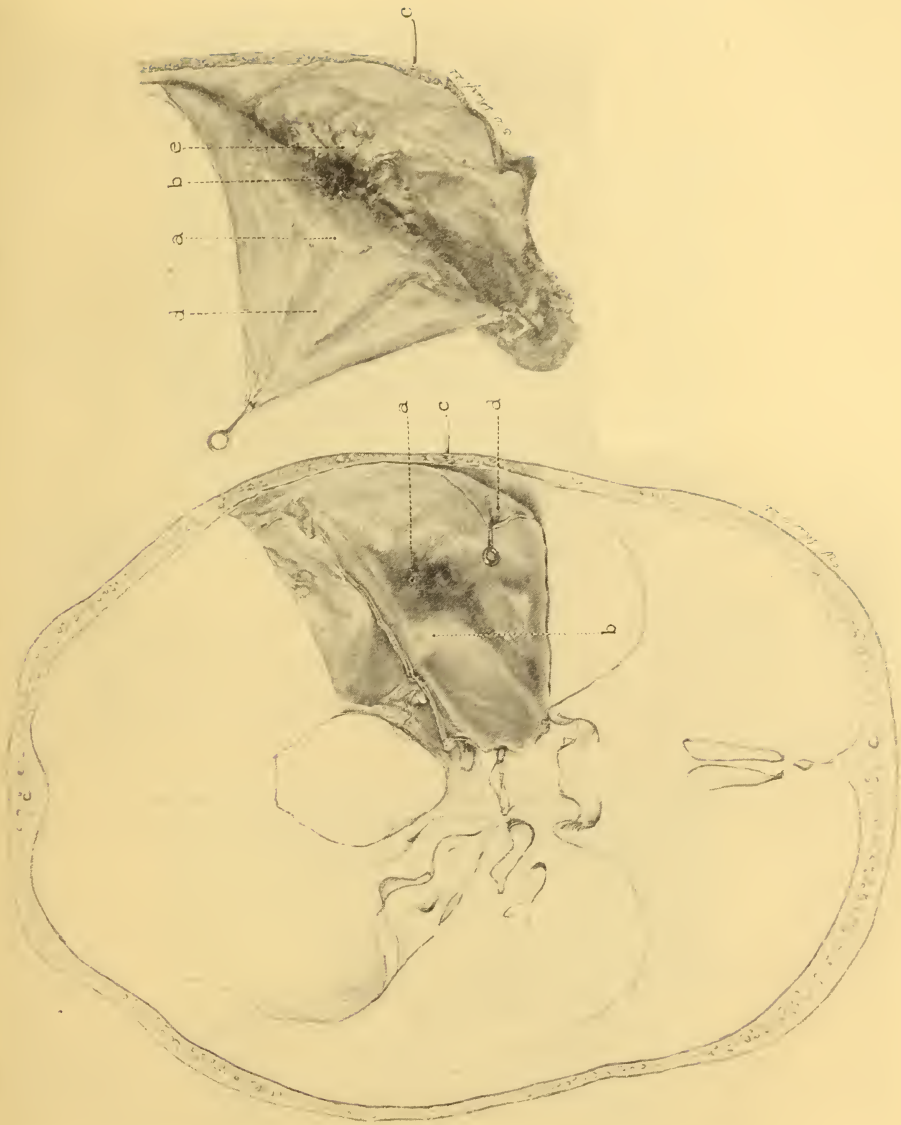

Fig. 1.—P. V. *a*, Discolored dura overlying hemorrhagic area at *b* in *detail; b*, eminentia arcuata; *c*, point above external auditory meatus; *d*, dura.

Detail: *a*, Extradural abscess covering; *b*, hemorrhagic area; *c*, point above external auditory meatus; *d*, dura retracted; *e*, area of osteomyelitis forming floor of extradural abscess.

Fig. 2.—P. V. A section through the temporal bone, shown in Fig. 1. *a*, Mastoid antrum, seat of extensive suppuration, with osteomyelitis of its bony roof; *b*, tympanic cavity, also the seat of suppuration; *c*, hemorrhagic extravasation; *d*, carotid artery; *e*, branches of the jugular vein; *f*, internal jugular vein; *g*, dura of the cerebellar fossa in close proximity to the suppurating antrum cavity; *h*, squamous portion of the temporal bone.

Fig. 3.—R. L. Pedunculated dural abscess; *a*, abscess stalk; point of attachment to dura; *b*, layer of cerebral tissue adherent to abscess; *c*, fibrous tissue wall of abscess; *x*, site of section shown in Fig. 13; *y*, site of section shown in Fig. 16.

Fig. 4.—L. F. Frontal view of brain with large abscess in right frontal lobe; *a*, adherent dura of frontal lobe reflected toward midline; *b*, perforation of dura; *c*, perforation in frontal lobe, which was continuous with *b* and formed the abscess stalk.

Fig. 5.—P. V. Frontal section of a brain with left temporal lobe abscess; *a*, abscess cavity; *b*, abscess wall and site of section shown in Fig. 18; *c*, site of section shown in Fig. 19.

Fig. 6.—P. V. A section through the temporal bone in Fig. 1; *a*, mastoid process; no evidence of suppuration; *b*, external auditory canal; *c*, squamous portion of temporal bone.

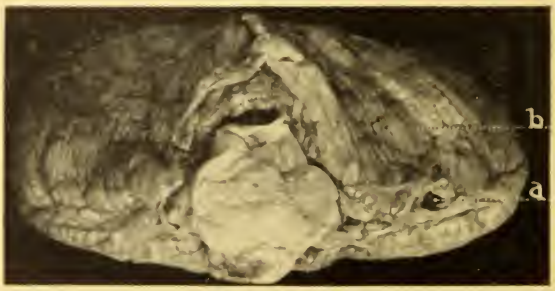

Fig. 7.—R. W. Upper surface of cerebellum, with abscess in left hemisphere underlying *b*. A cross-section of the abscess is shown in Fig. 24; *a*, point of spontaneous evacuation of abscess into the posterior fossa.

bone of P. V., may be considered typical of this extradural stage in the extension of the infection.

P. V., aged seventeen years. Left otitis media in early childhood, cured but purulent discharge from the left ear again three weeks before admission. Left temporal lobe abscess for approximately three weeks. Meningitis; drainage of the abscess. Death.

This small extradural abscess was the result of necrosis of the roof of the tympanic cavity. The intracranial surface of the dura was not involved in the inflammation and there were no adhesions between the dura and the cortex. A cross-section of this temporal bone (Fig. 2) showed extensive suppuration of the tympanic cavity and antrum with osteomyelitis of their bony covering.

The specimen shown in Fig. 3 was the result of extension by protrusion of the distended dura into the cranial cavity.

R. L., aged twenty-seven years. Pedunculated dural abscess, duration of approximately four months. Abscess removed without rupture. Recovery.

This abscess developed at the site of a necrosis of the occipital bone. The cause of the necrosis was not determined. The formation of the abscess differed from the usual extradural abscess, in which the dura is merely depressed into the skull cavity. In this instance only a limited part of the dura proliferated and was distended like a flask, owing to the slowness of the accumulation of pus.

Direct extension from the dural abscess is shown in Fig. 4.

L. F., aged twenty years. Influenza four months before admission, followed by right frontal sinus inflammation. Right frontal lobe abscess; probable duration, two months. Drainage of abscess. Death.

After necrosis of the posterior wall of the frontal sinus, a condition revealed at operation, there must have been an

extradural abscess, as shown in Fig. 1. The center of the inflammatory area of the dura was broken down and there was a direct communication between the extradural abscess and the frontal lobe, evidently through a local adhesion between the dura and the frontal lobe, preventing the spreading into a general meningitis. The perforations shown at *b* and *c* formed the stalk of a large frontal lobe abscess.

An abscess (the result of invasion from an extradural abscess along the bloodvessels) is shown in Fig. 5, marking the further extension from the extradural abscess shown in Fig. 1. The meninges between this temporal abscess and the extradural abscess were entirely free from inflammatory reaction. From the extradural abscess, or perhaps from the suppurating bone cavity, the inflammation seems to have been carried (as described under Group II.) along a vein and the superior petrosal sinus into the substance of the temporal lobe.

The formation of an extradural abscess as a first link of cerebral infection must be fully appreciated, as adequate treatment of the primary lesion at this stage may prevent the infection from extending to the cerebral tissue. Extensive suppuration of the tympanic cavity and mastoid antrum with osteomyelitis of their bony roof occurs in chronic cases without involvement of the mastoid process, so that symptoms of mastoiditis need not occur—for example, in Fig. 6 the mastoid process of the temporal bone shown in Fig. 1 is free from suppuration. Had symptoms of mastoid involvement appeared, the process would have been opened and the suppurating cavity in the bone, and perhaps the extradural abscess, adequately drained. Such a course was pursued with satisfactory results in the following case:

J. A. S., aged thirty-eight years, had purulent discharge from the left ear since his twelfth year. Headache and dizziness were troublesome for six months before operation.

A mastoid operation revealed extensive necrosis in the neighborhood of the antrum, and after the operation there was free drainage of pus from above the antrum. The post-operative course was satisfactory until the eleventh day, when there was frontal headache with mental confusion, slight aphasia, occasional twitching of the right shoulder girdle muscles and gradually increasing stupor. As an exploring needle introduced into the left temporal lobe did not reveal pus, it was concluded that the cerebral symptoms were due to edema secondary to the extradural abscess rather than to an extension of the infection. A decompression was done —the value of which lay in the relief of intracranial pressure —while the inflammatory process was checked by drainage of the extradural abscess through the mastoid antrum, with complete recovery.

External drainage of the area of bone necrosis, however, did not prevent the formation of the abscess shown in Fig. 3. It is possible that the drainage diminished the amount of pus to be taken care of by the abscess wall to a point where the proliferation of fibrous tissues could keep pace with the distention.

It is probable that the inflammation extends directly from the extradural abscess more frequently than by the other methods described. The tract between the abscesses in some instances remains patent and offers a means of spontaneous evacuation of the brain abscess. In one case there was a history of chronic otitis media for fourteen years, the drainage from the canal varying in amount. At times it was profuse, extending in a small stream from the canal and over the side of the face for a period of several hours. For three weeks prior to admission there had been very little drainage, but signs of serious increase of intra-cranial pressure terminated in respiratory collapse. While artificial respiration was being carried on preparatory to draining the abscess, there was a free discharge of foul pus from the canal, so that further evacuation was not undertaken.

In spite of this spontaneous drainage, death resulted from the serious medullary disturbance. At autopsy there was found a sinus extending from the tympanic cavity to a temporal lobe abscess.

Group II. Secondary Invasion of the Brain Along the Bloodvessels without Extradural Link. The superior petrosal sinus receiving the veins from both the tympanic cavity and the cortex of the temporal lobe constitutes an indirect vascular link through which infection may extend. The lateral sinus may likewise form a link between the mastoid cavity and the cerebellar hemisphere. The exact method of extension of infection along the bloodvessels cannot be outlined except where there is a thrombosis of the sinus, in which case the infected content of the sinus may be dammed back into its tributaries, and thereby carry organisms into the poorly resistant cerebral tissue. It is probable that merely a condition of phlebitis with retardation of the blood current may cause this forcing back of infected material. The correctness of this explanation can be determined only by further observation, the facts being that abscesses occur in the temporal lobe and cerebellar hemisphere secondary to the tympanic cavity and mastoid inflammation without visible connecting tracts, and that there exists the indirect anatomical connection stated above.

An illustration of an abscess formed in such manner is given in Fig. 7.

R. W., aged fifteen years. Left otitis media, mastoiditis and cerebellar hemisphere abscess. Probable duration of abscess three weeks. Streptococcus infection. Drainage. Death.

There is no evidence of involvement of the meninges, though the left cerebellar hemisphere contained a large abscess, the infection evidently having reached the deep substance of the cerebellum along the bloodvessels.

Group III. Penetrating Brain Injury with Infection by Foreign Body, Deep, with or without Stalk. Pene-

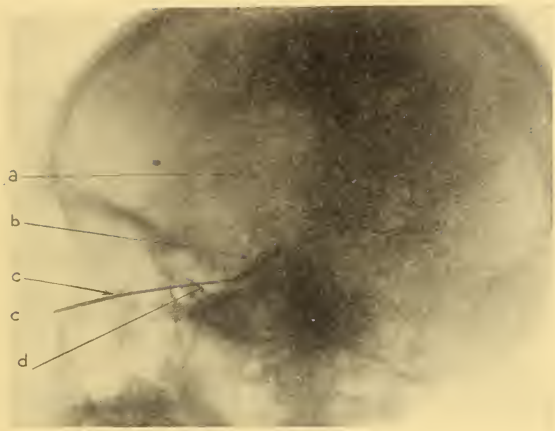

FIG. 8.—E. M. *a*, Bone defect at site of subtemporal decompression; *b*, metallic foreign body in the left temporal lobe; *c*, probe passed through the sinus marking the tract through which the foreign body passed; *d*, floor of the middle fossa of skull.

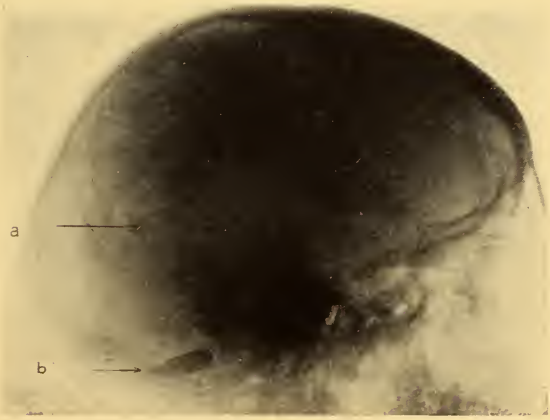

FIG. 9.—P. L. *a*, Small skull defect, site of entrance of machine-gun bullet seen at *b*.

Fig. 10.—W. F. M. *a*, Skull defect resulting from gunshot injury; *b*, large indriven bone fragments; *c*, small bone fragments, the center of an abscess.

Fig. 11.—W. F. M. *a*, Bone fragments shown at *c* in Fig. 10; *b*, fibrous tissue abscess wall and site of section shown in Fig. 12.

Fig. 12.—W. F. M. Section of wall from *b* in Fig. 11; *a*, inner layer of abscess wall, showing young fibrous tissue elements; *b*, outer layer of abscess wall, showing adult fibrous tissue. × 85.

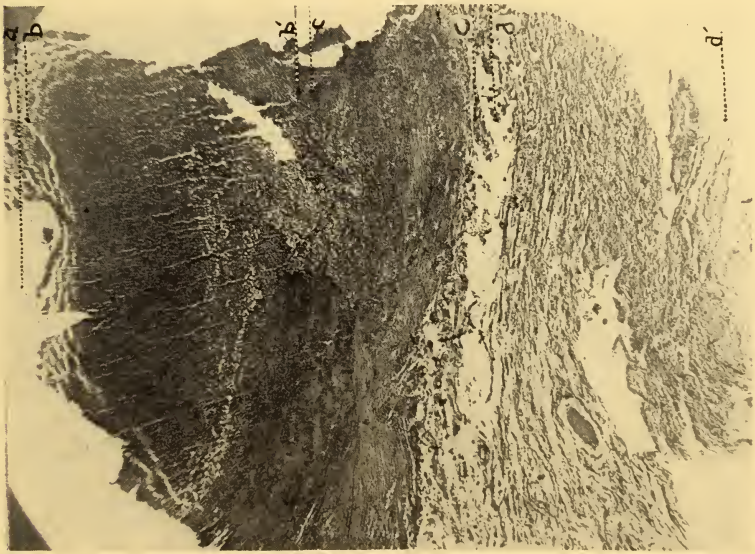

Fig. 13.—R. L. Section at *x* of wall of abscess shown in Fig. 3. *a*, abscess cavity; *b*, necrotic tissue covering inner surface of abscess wall; *c*, abscess wall shown also in Fig. 14; *d*, brain tissue, the site of active glial proliferation. × 15.

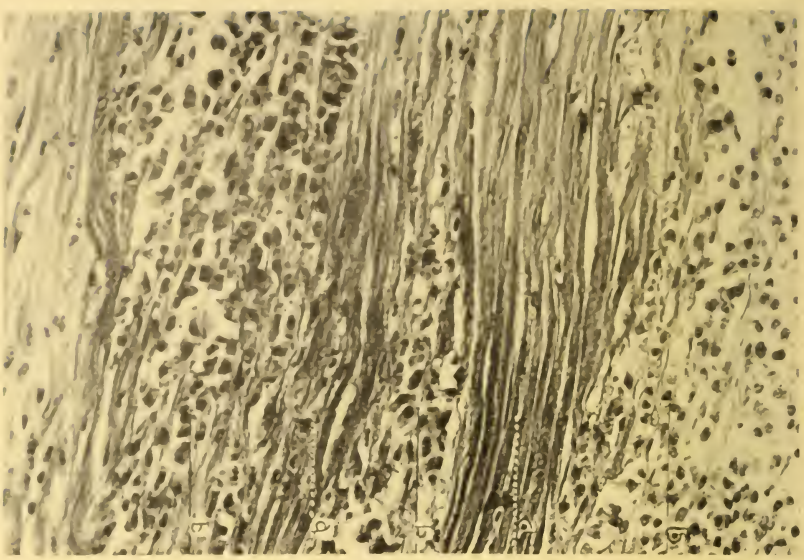

Fig. 14.—R. L. Higher magnification of a section from *c* in Fig. 13; *a*, adult fibrous tissue strands; *b*, young fibrous tissue elements. × 325.

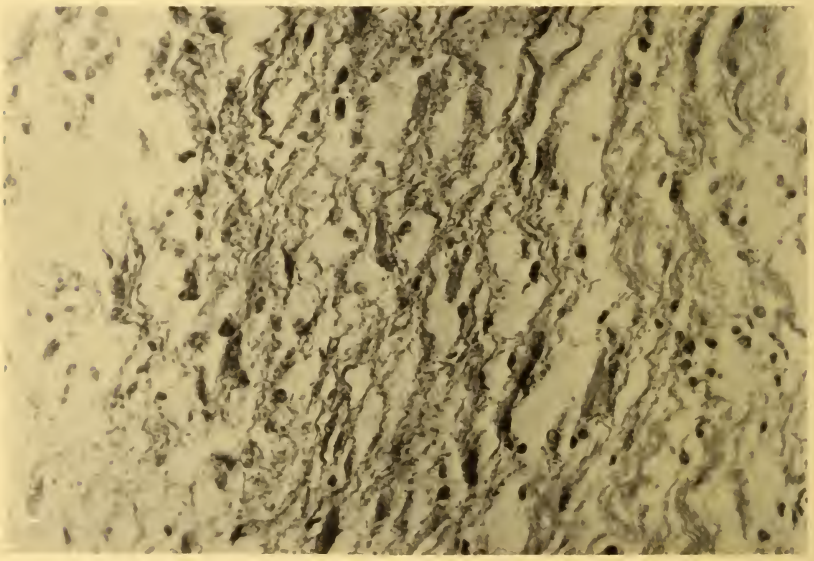

Fig. 15.—R. L. A higher magnification of *d* in Fig. 13, showing neuroglia fibrils. × 325.

trating wounds, complete or partial, are prone to infection at any point along the tract. Experience in the front-line hospitals proved the necessity of thorough cleansing of such wounds with a view to removing all devitalized tissue and foreign material, and when this was accomplished within a few hours after the injury, primary closure of the wound was possible. When the penetration was incomplete, foreign bodies were often lodged at such a depth in the brain substance that their removal was not possible at the front-line hospital. In addition, the stress of work at the front resulted in many cases being evacuated to the rear with incomplete operations. As a result of these conditions, cases were returned to this country, showing various types of cerebral lesions due to foreign bodies. In some, the foreign bodies were encapsulated and the healing was complete; in others, a discharging sinus extended from the foreign body in the substance of the brain to the skull surface, serving to prevent the accumulation of pus at the site of the foreign body; in others, the tract remained open, but the formation of pus was in excess of the amount discharged through the sinus, so that an abscess resulted; and in still others the tract healed and an abscess formed in the neighborhood of the foreign body.

An abscess with a path infected and open, forming a long abscess stalk, is shown in Fig. 8.

E. M., aged twenty-five years. Shell fragment entered the temporal lobe through the left malar region, August 17, 1918. Five months later symptoms of brain abscess. Left subtemporal decompression. Abscess drained, May 23, 1919. Recovery.

The tract through which the metallic foreign body entered the temporal lobe is shown in the roentgen-ray photograph, and is marked by the probe at *c*. This tract remained open and continued to discharge pus from the abscess cavity from the time of the injury until the operation.

An abscess in which the path of the bullet healed, leaving no abscess stalk, is shown in Fig. 9.

P. L., aged thirty years. Wounded, September 27, 1918. Drainage of abscess and removal of bullet, May 10, 1919. Recovery.

The abscess cavity is cut off from the wound of entrance by healing of the tract, which extended through the occipital lobe and tentorium into the right cerebellar hemisphere.

The discharging sinus in the case of E. M. no doubt prevented the formation of the temporal lobe abscess for a number of months, and would have been more effective but for the effort made to have this tract heal, as its connection with the foreign body was not considered. The abscess was finally drained through part of the original tract, for after its communication with the abscess was discovered an incision in the temporal region exposed the proximal end of the tract just below the floor of the middle fossa of the skull, at which point very satisfactory drainage was obtained. The abscess was large, with extensive destruction of cerebral tissue, which resulted three years later in circulatory disturbance and impairment of function.

The other patient cited in this group was without symptoms of cerebellar disturbance. Removal of the foreign body was advised, because of its size and the likelihood of cyst formation, with destruction of cerebellar tissue. When the cerebellar cortex was opened there was a flow of pus which contained staphylococci.

Group IV. Abscess Superficial and open, Secondary to Direct Laceration and Infection of Brain Tissue. Abscesses developing in neglected cases of compound fracture of the skull in which the surface opening is sufficiently large to permit a fairly free drainage of pus, often tend to do well when the foreign material is removed and drainage established. In these cases the encephalitis which follows the injury is localized and circumscribed by the proliferation

of the neighboring mesoblastic tissue. Here, again, the dura plays an important rôle. In some cases, at least, the ragged dural flaps, dipping into the disorganized cortex, proliferate and completely shut off the foreign material from the brain, so that the resulting abscess is essentially extradural.

In the roentgen-ray photograph in Fig. 10 are seen shadows of the bone fragments extending in from the rim of the skull defect.

W. F. M., aged twenty-five years. Machine-gun bullet wound, October 5, 1918. Bullet only removed at front-line hospital. Wound unhealed; constant drainage of pus. Operation: Removal of firm wall abscess containing bone fragments, May 31, 1919. Death.

Fibrous tissue surrounding the large bone fragments at *b* formed the stalk of a thick-walled abscess, in the center of which were contained the small fragments seen at *c*. The abscess is seen in Fig. 11. The thick fibrous wall surrounding the fragments, as seen in Fig. 10, must have been due to proliferation of fibrous tissue carried in with the bone fragments as the mass extended deep into the substance of the hemisphere entirely out of reach of any considerable amount of fibrous tissue. The character of the wall cannot be attributed to the long duration alone, as other abscesses in the hemisphere, the result of the same injury, showed almost complete lack of fibrous tissue elements.

Behavior of the Brain with Regard to the Formation of the Abscess Wall after the Introduction of Infection.

The term abscess indicates a circumscribed accumulation of pus, and in this way the lesion under discussion, suppurative encephalitis, differs from the diffuse type of cerebral inflammation, which is not amenable to surgical

treatment. Only the end-results of the inflammatory process, namely, the abscess wall, will be treated in this paper. (1) The wall of the abscess is the most important factor in determining the outcome of well-managed brain abscesses. As in all other inflammatory lesions, the wall formation depends first upon the type of infecting organism, one of low virulence causing a more gradual accumulation of pus than one of greater virulence, thus allowing sufficient time for the protective reaction of the tissue; (2) the resistance of the infected tissue is important, which protective reaction takes place principally in two kinds of tissue, fibrous mesoblastic and glial epiblastic. The fibrous tissue is far more effective, but, unfortunately, is almost unavailable in the deep substance of the brain where glial tissue must suffice. In addition, it is influenced by the method of infection, as shown in the first part of this paper.

Abscesses of long duration may have walls of greater thickness, but it is more likely that the duration is long and the wall thick, because of the character of tissue available for proliferation.

Types of Abscess Wall

Type I. Dense fibrous mesoblastic tissue wall.

Type II. Fairly firm wall, containing some fibers proliferated from neighboring mesoblastic tissue.

Type III. Walls of varying thickness the result of glial proliferation.

Type IV. Walls showing no evidence of a protective reaction.

Type I. Dense Fibrous Mesoblastic Tissue Wall. If fibrous tissue is available for the abscess wall, it takes first place in the formation of the protective membrane. The meninges, constituted largely of fibrous tissue, act as a barrier to pus (as in extradural abscess formation) and

Errata

Magnification in Fig. 17 should be 300; in Fig. 20, 325; in Fig. 21, 6; in Fig. 22, 325; in Fig. 23, 85; in Fig. 25, 85; in Fig. 26, 85.

Fig. 16.—R. L. Section at *y* of wall of abscess shown in Fig. 3; *a*, abscess cavity; *b*, necrotic substance covering inner surface of wall; *c*, young fibrous tissue elements; *d*, adult fibrous tissue; *e*, site of section shown in Fig. 17. × 15.

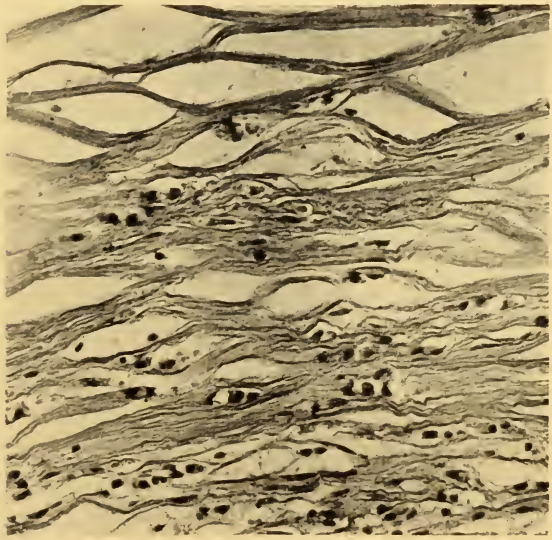

Fig. 17.—R. L. Higher magnification of section at *e* in Fig. 16 showing firm fibrous tissue strands. × 225.

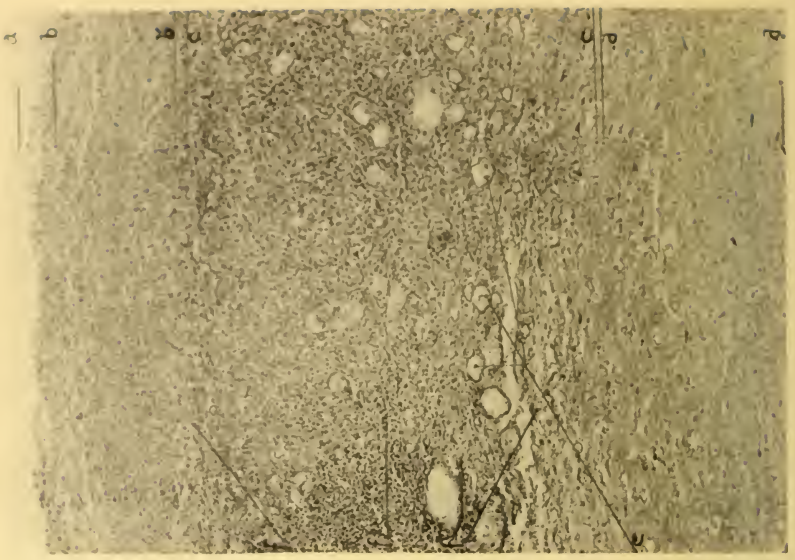

Fig. 18.—P. V. A section from *c* in wall of abscess shown in Fig. 5; *a*, abscess cavity; *b*, necrotic substance on inner surface of abscess wall; *c*, abscess wall; *d*, brain tissue; *e*, thin wall bloodvessels; *f*, framework of abscess wall consisting chiefly of fibrous tissue proliferated from the bloodvessels. × 85.

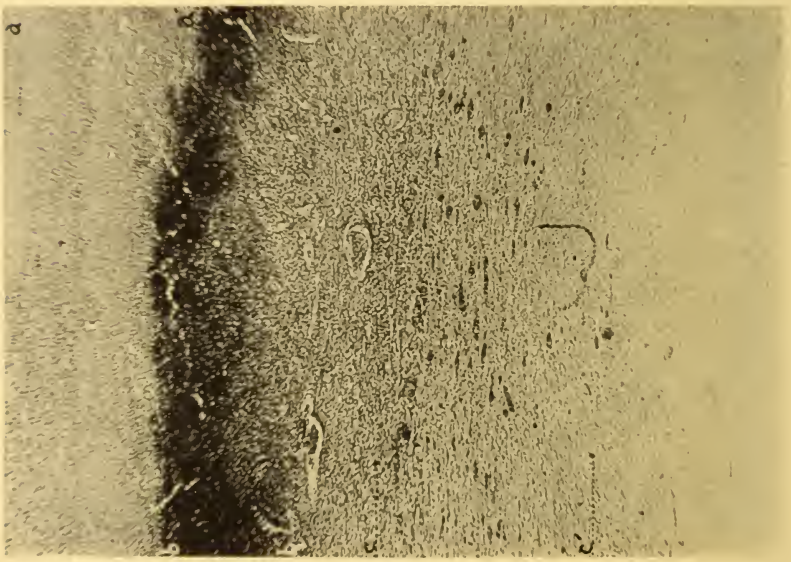

Fig. 19.—P. V. A section from *b* in wall of abscess shown in Fig. 5; *a*, inner layer of abscess wall; *b*, hemorrhagic extravasation in abscess wall; *c*, outer portion of abscess wall, showing extensive vascular proliferation and numerous punctate hemorrhages. × 85.

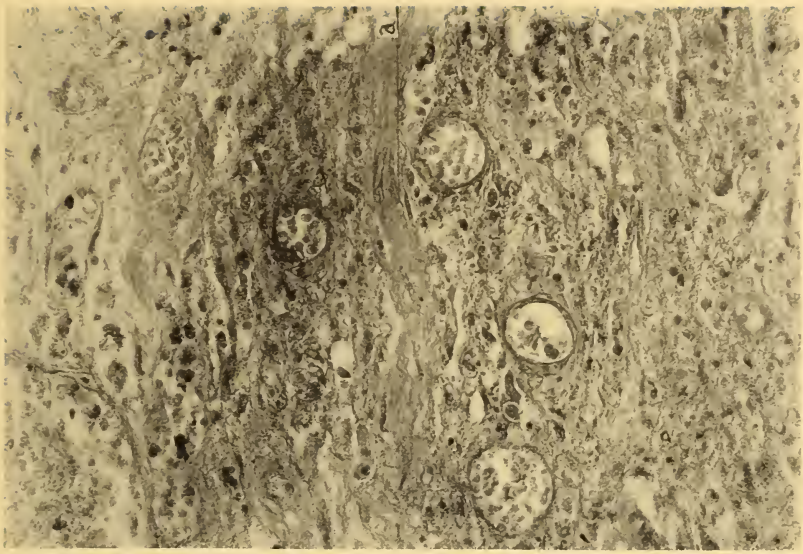

Fig. 20.—W. F. M. Section from an abscess wall similar in type to that shown in Fig. 18, but of longer duration; *a*, small band of adult fibrous tissue. × 500.

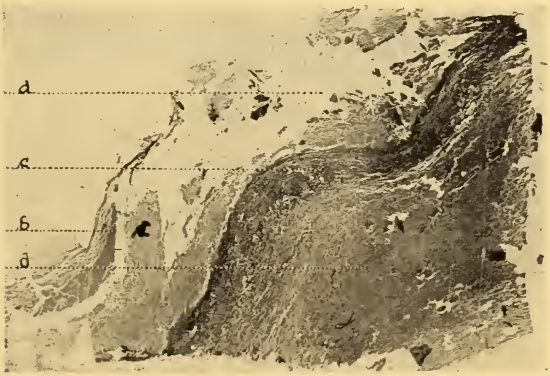

Fig. 21.—L. F. A section from the wall of the abscess shown in Fig. 4; *a*, abscess cavity; *b*, disorganized tissue of inner abscess wall and site of section seen in Fig. 23; *c*, abscess wall; *d*, brain tissue adjacent to the abscess wall. × 10.

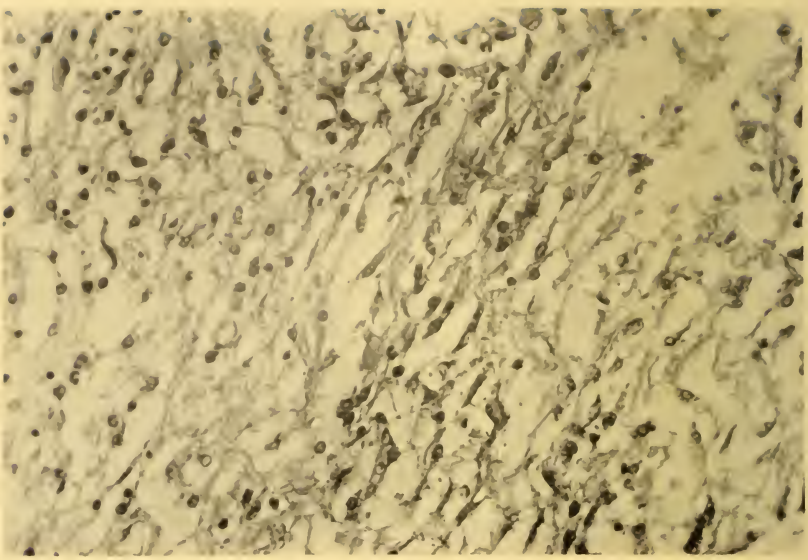

Fig. 22.—L. F. A higher magnification of the wall of the abscess seen in Fig. 21 showing the membrane to consist of delicate fibrils.

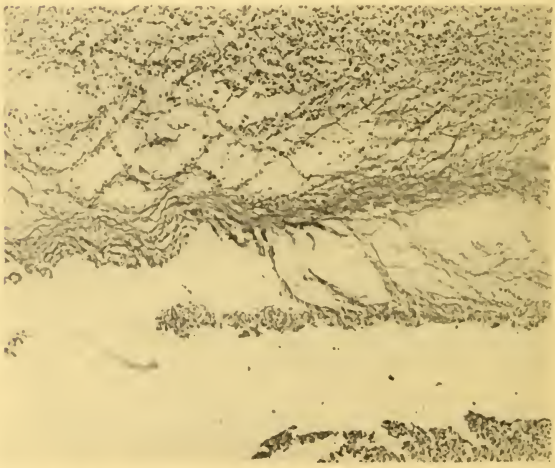

Fig. 23.—L. F. Section of the innermost portion of abscess wall in Fig. 21. Because of the necrosis the cellular elements have fallen out leaving the delicate fibers in plain view. × 125.

may furnish tissue for active proliferation and the walling-off of infection even though the membranes be severely traumatized. Figs. 11 and 12, for example, show the result of proliferation after a smashing skull injury. Fig. 11 shows the firm wall abscess removed from W. F. M. at operation in cross-section. Fig. 12, a photomicrograph of the abscess, shows the wall to be made of mesoblastic fibrous tissue.

A very unusual reaction of the dura appears in Figs. 12 to 17, photomicrographs of a large abscess of four months' duration, which was confined entirely within the limits of the dural tissue. In Fig. 13 the same abscess as shown as in Fig. 3, the firm, fibrous tissue wall was the result of proliferation of the slowly distending dura. The next figure (Fig. 14) shows adult fibrous tissue strands and young fibrous tissue elements in this same abscess. Fig. 16, shows the tensile quality of the fibers constituting the wall of the abscess, for a few strands were sufficient to protect the abscess against rupture. The quality of these strands is shown in Fig. 17. Beyond the fibrous tissue wall there was neuroglial proliferation as shown in Fig. 15. This latter reaction of cerebral tissue, of little importance in this case, is the main protective reaction in the wall of the abscess designated as Type III. in this paper. The similarity between Fig. 15 and Fig. 22 is striking.

It is evident that the method of infection and the propinquity of mesoblastic tissue to the site of infection influence greatly the above-described formation of an abscess wall.

Type II. Fairly Firm Wall Containing Some Fibers Proliferated from Neighboring Mesoblastic Tissue. The type of abscess wall shown in Fig. 18, while not the most valuable, represents the usual form of reaction when the infection occurs deeper than the fibrous tissue coverings. The chief reaction takes place in the glia, but this is augmented by proliferation from the mesoblastic elements of the bloodvessels. In addition to the avail-

ability of the mesoblastic tissue, the quality of the resulting wall is likely to improve somewhat with the duration of the process. In our specimens, all of which were of less than a year's duration, the fibrous tissue proliferation reached a stage in no sense approximating the density of the wall shown under the heading of Type I. In Fig. 20 the small band of fibrous tissue represented the most advanced stage of the fibrous tissue proliferation of an abscess wall which had existed as long as the wall shown in Fig. 11. Hassin,[1] however, described a wall of eight years' duration in which the outer layer of the abscess wall was made up of adult fibrous tissue strands.

The question of time necessary for the proliferation of an abscess wall is an important one. It is certainly unusual for an abscess to exist for a period longer than a few months, and walls of this type may be formed with great rapidity, the history of the abscess shown in Fig. 18 indicating that the wall was formed within a period of three or four weeks. The hemorrhages shown in Fig. 19 were no doubt due to the very active vascular proliferation in the soft cerebral tissue.

Type III. Walls of Varying Thickness the Result of Glial Proliferation. Walls formed almost entirely of glial fibrils may be very heavy, but because of the delicate character of the fibrils the wall is not so resistant as one in which there is fibrous tissue. In Fig. 21 the wall was visible macroscopically, and in this picture of low magnification has the appearance of a thick limiting membrane, but the delicate quality of the tissue is shown in Fig. 22. The relative value of this type wall and the firm fibrous tissue wall is perhaps best shown in Fig. 13, in which there is a firm fibrous tissue wall at *c* and at *d*, the adjacent cerebral tissue with glial proliferation. A photomicrograph of *d*, given in Fig. 15, is similar to the abscess wall shown microscopically in Fig. 22.

[1] Hassin, G. B. Histopathological Studies on Brain Abscess. Med. Rev., 1918, xciii, 91–96.

The neuroglial fibrils are again well shown in Fig. 23, which was taken from the innermost part of the abscess wall. A large part of the cellular element has fallen out because of the necrosis, leaving the fibrils in plain view.

Type IV. Walls Showing no Evidence of a Protective Reaction. Fig. 24 shows an abscess which was the result of a virulent streptococcus planted deep in the substance of the cerebellar hemisphere. There is no evidence of a protective reaction and the lesion marks an intermediate stage between an encephalitis and the usual abscess formation, for though suppuration occurred there was no true barrier between the pus and the brain tissue. At *b*, in Fig. 24, there is an area of hemorrhagic extravasation the result of thrombosis, which is also well shown in Fig. 25, the destructive process entirely replacing the usual proliferative reaction. The merely necrotic end-result of the destructive process is shown in Fig. 26.

Abscesses of this type also occur as secondary lesions to firm wall abscesses. In Fig. 27 the primary abscess has a thick wall, the building of which, no doubt, required several weeks; but the extension from this abscess was doubtless more recent, due to escape of pus into the substance of the occipital lobe, an invasion altogether too sudden to allow the slowly proliferating glial tissue to form a protecting membrane.

D. F., aged twenty-nine years. Gunshot wound in the left hemisphere, July 14, 1918. Constant drainage of pus from the wound. Drainage of abscess, June 22, 1919. Death, June, 30.

The architecture of the wall of the primary abscess is similar to that described under Group II. The firmness of the wall and heavy consistency of its content indicate a long duration. At *b*, however, is a larger abscess cavity with soft necrotic walls, evidently due to a more recent extension from the original abscess.

Fig. 28 shows an abscess, also the result of extension from the firm wall abscess, as seen in Fig. 5. There was evidently leakage of pus into the occipital pole of the ventricle, which was shut off anteriorly from the remaining part of the hemisphere ventricle, so that the occipital pole was converted into an abscess cavity. Extending from the ventricle to the inferior surface of the brain an inflammatory tract marks the site of the escape of pus into the subarachnoid space.

Fig. 29 is a section from the ventricle wall of the specimen shown in Fig. 28, illustrating the poor quality of the abscess wall, which consists only of necrotic brain tissue entirely incapable of acting as a barrier to the pus content in the cavity.

The escape of pus from the abscess into the ventricle is a very common method of termination of neglected abscesses, but the conversion of a portion of the ventricle into an abscess cavity, as shown in Fig. 26, is certainly an uncommon reaction. The formation of secondary abscesses may be due to the ineffectiveness of an abscess wall as a barrier to constantly accumulating pus or to organisms, so that such extension is dependent upon the duration of the abscess and the virulence of the organism producing it.

Summary. The clinical course of a brain abscess varies according to the infecting organism, the channel through which this organism reaches the brain and the location of the infection in the brain substance as regards mesoblastic and epiblastic tissue.

This pathological study has been made as a basis for further consideration of the clinical data concerning these abscess cases.[2]

[2] This work has been done in the Neurological Laboratory of the Phipps Psychiatric Clinic, Johns Hopkins University, and has been greatly facilitated by the interest and coöperation of Dr. Adolf Meyer. I am much indebted, also, to Miss Cecelia Bisson, for the histological and photographic preparation of the material.

Fig. 24.—R. W. Cross-section of cerebellum seen in Fig. 6; *a*, abscess cavity; *b*, area of hemorrhagic extravasation, the result of thrombosis; *c*, site of section shown in Fig. 25; *d*, site of section seen in Fig. 26.

Fig. 25.—R. W. Section from *c* in Fig. 24. Note the large and small areas of thrombosis. × 125.

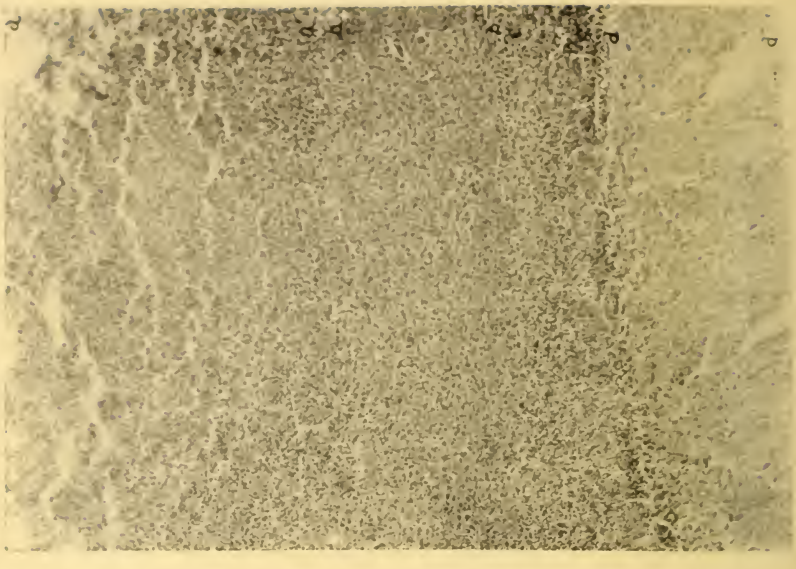

Fig. 26.—R. W. Section from *d* in Fig. 24; *a*, necrotic brain tissue surrounding the abscess cavity; *b*, nervous tissue beyond the area of necrosis; *c*, layer of granular cells of the cerebellum; *d*, molecular layer of the cerebellum. × 75.

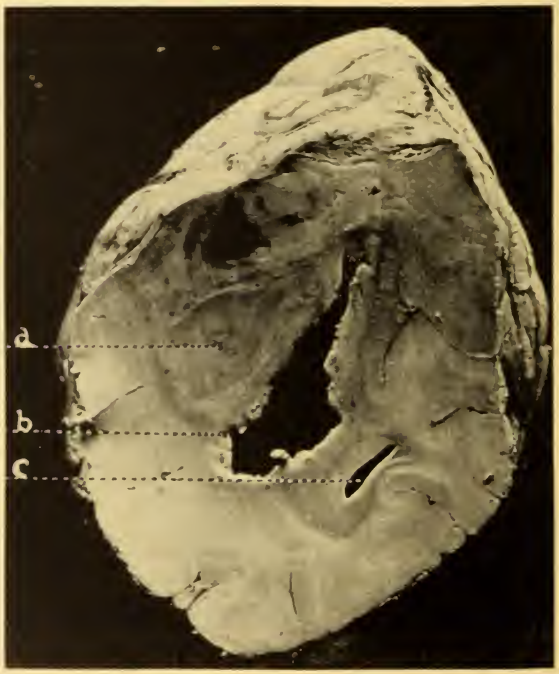

Fig. 27.—D. F. A transverse section through occipital pole of brain; *a*, primary abscess with firm wall; *b*, secondary abscess cavity; *c*, occipital pole of lateral ventricle.

Fig. 28.—P. V. Transverse section through the occipital pole of the brain shown in Fig. 5; *a*, occipital pole of the lateral ventricle converted into the abscess cavity with the necrotic wall; *b*, area of encephalitis, tract of evacuation of pus from the ventricle cavity to the subarachnoid space; *c*, thickened pia-arachnoid; *d*, site of section shown in Fig. 29

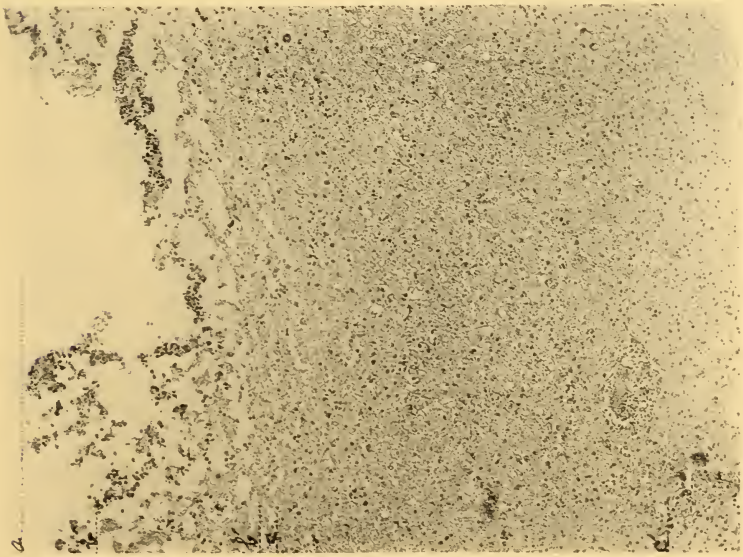

Fig. 29.—P. V. Section of the abscess wall at *d* in Fig. 28; *a*, abscess cavity; *b*, necrotic brain tissue surrounding pus; *c*, brain tissue beyond the necrotic zone. × 85.

DISCUSSION OF THE PAPERS OF DRS. KERR AND BAGLEY

Dr. James M. Mason, Birmingham, Ala.—These papers are extremely interesting, and I want to say a few words in regard to the pathology applied to Group 2, where we have bone necrosis with the formation of brain abscess.

Several years ago I published in the *Annals of Surgery* a short paper entitled, "A Study of Burns Involving the Periosteum of the Vault of the Skull." I had 2 patients under treatment at the same time, one of whom had a large burn on the left side of the head, which denuded the left parietal bone of all soft tissues for an area of two and one-half inches in diameter. The other patient had a similar burn over his frontal bone and also over his occipital bone. The soft tissues, including the periosteum, were cut away, leaving the outer table of the bone exposed. The wounds were treated antiseptically and we were waiting for separation of the sequestra. One patient, who had previously been perfectly comfortable and practically well, suddenly developed hemiplegia and died within forty-eight hours.

At autopsy we removed the exposed portion of the parietal bone and found that the outer table was necrotic over the entire area, which had been denuded of soft tissues. It was beginning to separate from the inner table. The inner table we found intact, except at a point about a quarter of an inch in diameter at its center. This was necrotic and came away attached to the outer table. The whole sequestrum was in a state of subacute osteomyelitis. At the point where the necrotic inner table touched the dura an extradural abscess had formed. From this abscess infection traveled through the dura, and an enormous brain abscess developed from the point of contact with the under surface of the dura, opposite the site of the extradural abscess. After we observed the pathologic condition in this case, we lost no time in removing the exposed portions of the frontal and occipital bone in the other case. On removing these bones we found, in each instance that the outer table was necrotic and that the inner table was intact, except for a small necrotic area at its center, presenting the same picture of osteomyelitis, as was seen in the first case. By removing these two portions of necrosed bone we prevented

the development of extradural abscesses and brain abscesses in this case, and the patient went along to complete recovery. The denuded areas were covered over by skin grafts.

Dr. Charles E. Dowman, Atlanta, Ga.—These two papers are excellent contributions to the subject of brain abscess. Dr. Kerr touched on some principles of treatment which I think should be emphasized, I refer particularly to the treatment of single abscess of the brain following infection of the mastoid or frontal sinus.

The serious complications of brain abscess after operation are meningitis and brain fungus. The development of these complications depends to a large degree upon the type of treatment instituted. The fundamental principles in the treatment of brain abscess are: (1) Accurate localization, which is sometimes difficult; (2) the avoidance of large openings in the skull; (3) the establishment of free drainage only after protective adhesions between dura and brain cortex have been induced Decompression is a terrible thing to do in brain abscess, as it allows the abscess to extend toward the point of least resistance, thereby producing unnecessary and further destruction of brain tissue. The laying down of bone flaps should also be avoided if possible. The same fundamental principles should be observed that obtain in the treatment of abscess of the liver and lungs.

The following is briefly the technic which I have used during the past year: (1) The incision is just long enough to allow room for the perforator and burr in effecting an opening through the skull; (2) a slit in the dura large enough to avoid puncturing a cortical vessel with the exploring needle; (3) a search for the abscess with an ordinary ventricular puncture needle with centimeter markings; (4) as soon as the abscess has been located the immediate withdrawal of the exploring needle after calculating the depth and direction of the abscess so as to avoid at this time the free escape of pus; (5) the insertion of a filiform drain of folded rubber tissue down the track of the exploring needle in the direction of but not into the abscess; (6) the prevention of the establishment of free drainage until protective adhesions have been formed between the brain cortex and dura around the rubber tissue drain which acts as a foreign body; (7) the establishment of free drainage by means of a small rubber tube drain after these protective adhesions have

been formed; (8) the avoidance of the permanent withdrawal of the drain until a week or ten days after all evidence of infection has subsided.

By using this method of treatment the occurrence of meningitis can be largely prevented as the meningeal spaces have been protected from infection. A brain fungus can hardly occur, as the opening in the skull and dura is just large enough to permit the entrance of the necessary drain.

Dr. Francis G. Dubose, Selma, Ala.—In the discussion of these papers I desire to report a case: This patient was a woman sent to the hospital with a right-sided mastoiditis. She had the services of a specialist, a competent ear surgeon, who did a radical mastoid operation on the right side, but the patient did not recover. She developed headache and optic neuritis, and he suggested that a subtemporal decompression operation be done on the right, as it was probable that her abscess was in the sphenoidal lobe. In making the usual plastic incision we avoided the mastoid field, which at the time of operation was fairly clean. On aspirating the lateral ventricle I failed to get any cerebrospinal fluid. The dura was extraordinarily tense. A thorough exploration of the right hemisphere for abscess was made through a small split in the dura. A triangular flap of the dura was made and extraordinary bulging of the cortex resulted. A spinal puncture with the withdrawal of 20 cc of cerebrospinal fluid did not lesson the pressure in the cortex. The wound was closed and the opinion given that the abscess was on the other side. Two days later a subtemporal decompression operation was done on the left side, and the abscess was found in the left temporosphenoidal lobe on the opposite side from the diseased mastoid. The abscess was drained, but as usual in these bad cases the patient died.

It is not difficult to diagnose brain abscess, but it is frequently extraordinarily difficult to locate the abscess. Those who have had the opportunity to observe the work of Sir Victor Horsley on localization of brain abscess that realize the surgeon needs the assistance and coöperation of an expert neurologist.

PEDICULATED POLYPOID FIBROADENOMA OF THE STOMACH OF BALL-VALVE TYPE CAUSING AN UNUSUAL AND COMPLEX SYNDROME

PERIODIC CRISES OF INTENSE EPIGASTRIC PAIN, WITH SHOCK, VOMITING, MELENA (TARRY STOOLS) AND PROFOUND SECONDARY ANEMIA.

TRANSFUSION; COMPLETE RELIEF AND RECOVERY FOLLOWING EXTIRPATION OF TUMOR BY GASTROTOMY.

A CLINICAL REPORT, WITH DISCUSSION

By Rudolph Matas, M.D.,
New Orleans

*Clinical History.** Mr. W. F. M., aged fifty-five years, farmer, native of Mississippi, has resided in the country all his life. There is nothing in his heredity or in his personal history of any importance as related to his present condition. He has always been a hard-working farmer, enjoying excellent health and well able to keep up with any of the men in the field.

His present trouble began rather suddenly sixteen months ago. He had worked hard on a very hot day and perspired freely. "He relaxed after the day's work was over and took no precaution against taking cold." The next morning he felt pain in the chest, especially in the left costal margin, on breathing. He paid no serious attention to the pain at the time, but the pain became so much worse that a doctor had

* Abridged from the records of the Touro Infirmary, by Dr. J. Cohen, intern.

to be summoned, who told him that he had pleurisy. He had some fever at that time. In a few days he was well and went back to work. While in the field, two weeks later, he suddenly fainted. He was taken home and remained in bed for four days, growing weaker daily and losing his appetite gradually. At the end of four days he "picked up" and began to recover. The following week saw him out on the farm again. Some weeks later a third attack came. This time he had violent pain in the epigastrium, followed by complete collapse. Again he became profoundly weak, lost his appetite, had slight temperature and excessive perspiration at night. This time he had violent pain in the epigastrium followed by complete collapse. Again he became extremely weak, lost his appetite, had slight temperature and excessive perspiration at night. He was treated this time for pulmonary tuberculosis. He recovered after a time sufficiently to work again on the farm, when a fourth attack come in the form of a sudden and sharp pain in the pit of the stomach, with nausea and vomiting. During this spell he had a number of loose stools of a tar-like color. He was then advised to have a roentgen-ray examination. In the interim between this attack and his admission to the infirmary he had several of these "up-and-down spells," each one coming closer, lasting longer and disabling him more than the preceding one. *During an attack he was always seized by an acute violent pain in the epigastrium, accompanied by shock and a sense of persistent depression, faintness, pallor, with nausea and vomiting of gastric contents (no blood), followed soon after by the passage of dark, tarry stools. The attacks were of variable duration and intensity and lasted from a few minutes to a few hours.* These spells would cease spontaneously, but more often required morphine and other sedatives to quiet him. After the crises, he would pick up, gain strength, look better and feel inclined to work, but each succeeding attack left a deeper impression on his strength and a greater pallor. The pain in the epigastrium was an invariable accompaniment of an attack.

Nausea, vomiting and loose, tarry stools were not always present.

By the advice of his physician he came to New Orleans and consulted Dr. John B. Elliott, who admitted him to the Touro Infirmary on January 11, 1922. After careful examination and repeated radiographic sittings, he concluded that the patient had an ulcer at the pylorus, whether or not malignant he could not tell, but advised that the patient be operated upon promptly "as the only chance he had for his life." He returned home on his discharge from the infirmary on January 13, 1922. Having had another severe attack in the meantime, he returned to the hospital on January 17, 1922, and applied to Dr. Matas for surgical relief.

Condition on Admission, January 17, 1922. The picture of a tall, powerful man, 6 feet 2 inches, normally weighing 185 pounds, now a physical wreck from the effects of malnutrition, emaciation and pain; he is strikingly anemic and totters from weakness. The lips and tongue are dry and the skin warm; the teeth are neglected and the breath foul. Except for the persistent weakness and loss of flesh, with the complaint of a gnawing pain localized in the epigastrium and radiating to the back, the physical examination of the patient is largely negative. The abdomen is retracted, scaphoidal and no tumor can be palpated in the epigastrium or anywhere in the abdomen. The attacks of pain that he complains of have no relation to the time of eating, quality or quantity of food. They come independently of the meals. On admission the pulse is 100; blood-pressure: systolic 124, diastolic 58; pulse-pressure 66; temperature, 100°. The urine showed a trace of albumin with a few granular and hyaline casts; Blood: total red count, 1,762,000; hemoglobin 30 per cent; color index 88; total white count 4050; differential: Small-20; large-4; neutrophiles-75; eosinophiles-1; anisocytosis; poikilocytosis. The gastric analysis showed a hyperchlorhydria, *no blood*. The feces show occult blood in every examination. The radiographic laboratory (January

13, 1922) among other less important details, reports: "There is a marked deformity about the pylorus and stomach. A serial radiographic examination following the second barium meal showed a large filling defect about the pylorus, probably due to an extensive ulcer or beginning malignancy. The stomach emptied readily and is empty entirely at the end of six hours. Conclusions: *Saddle ulcer, probably malignant.*"

In the light of the operative findings it is easier to interpret the radiographs of the pylorus, but even with all of the knowledge obtained through the operation, it is evident that the correct diagnosis could not have been made by the radiograph alone.

The patient was admitted in a period of calm. He then could eat and drink with seeming impunity, but he had no appetite. However, in order to prepare him for the operation, he was put on a milk diet, with eggs, gelatin and thin cereals, at regular intervals, and a Murphy drip instituted, containing glucose 5 per cent, panopepton, calcium chloride and gelatin to counteract the hemorrhages. Digalen, (minims 10) with morphine ($\frac{1}{8}$ gr.) and atropine were given by needle nightly.

Transfusion. January 19, on the third day after admission, 400 cc of citrated blood obtained from the patient's son were transfused by Dr. Lucian H. Landry. No immediate notable effect followed except a febrile reaction, 101° F., the next day, and continued with remissions to the third day after transfusion. There has always been an underlying febrile movement since his admission, with a daily variation of 1° above and below the normal line. The blood-pressure rose 20 points and the blood picture improved only a little. The benefit from this transfusion appears to have been transitory. The absence of pain and vomiting and tarry stools seems to have improved the patient. On January 20, three days after admission, the patient was brought to the operating room, only to be sent back after careful deliberation with the

anesthetist, Dr. Caine, as too great a risk and unfit to undergo any serious operation. The diastolic blood-pressure then was barely 58 and the hemoglobin a little over 30 per cent.

Again sytematic feeding was resumed and a daily record of blood-pressure and of the character of stools was kept. For two weeks this was continued, although the blood-pressure scarcely arose over 65 diastolic, and the hemoglobin to 45 per cent. Nevertheless, the freedom from pain and apparent cessation of intestinal hemorrhage contributed to the improvement of the patient. As he improved, he became restless and impatient for operation.

Operation. (Notes dictated by Dr. Matas.) This was performed February 3, 1922, sixteen days after the patient's admission to the infirmary. Under gas-oxygen anesthesia (Dr. Caine) the abdomen was opened by epigastric incision, right rectus, a little to the right of the midline. The exploring hand of the operator at once palpated the pylorus, which was thickened and enlarged, giving the impression that it was the seat of a neoplasm which involved the whole pyloric contour on the gastric and duodenal sides of the pyloric ring. A mass seemed to block the pyloric ring and project into the duodenum. *While attempting to exteriorize the pylorus for further inspection, the manipulations dislodged the mass in block, and, to our surprise, this retreated completely within the stomach, leaving the pyloric ring free but without the slightest evidence of infiltration or thickness of any sort.* It seemed then that there was a foreign body of soft consistency, the nature of which we could not determine, but which by blocking the pylorus acted as a ball valve, accounting in this way, at least, for the periodicity of the attacks.

Taking every precaution to prevent the spilling of the gastric contents, and in order to control the movements of the mass (which had migrated far up in the gastric cavity, requiring considerable manipulation to recover and hold it in place), the stomach was clamped above and below the mass with a pair of thin Doyen forceps. After the stomach

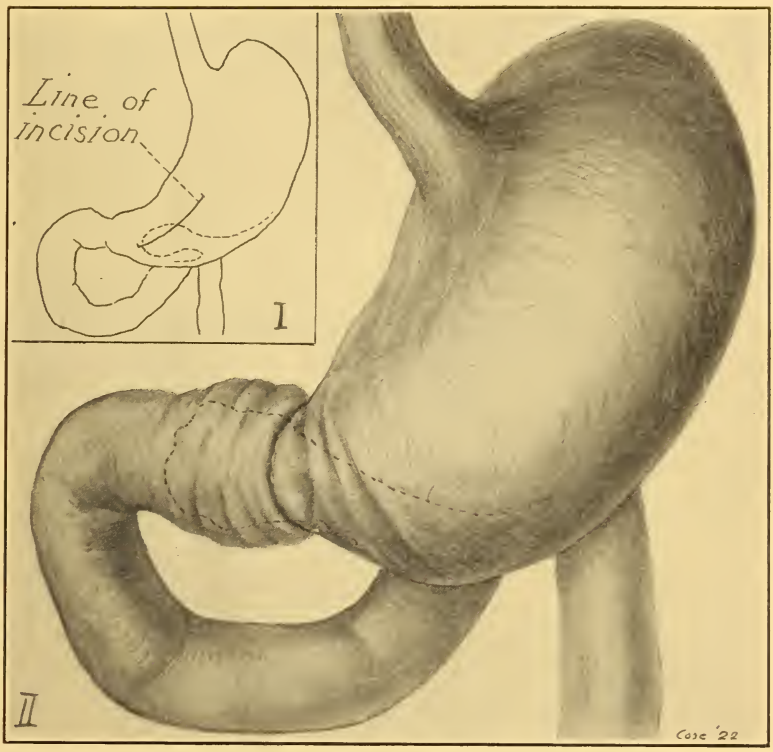

Fig. 1.—Pedunculated polypoid fibro-adenoma of the stomach. *I* shows the normal position of the growth in the quiescent stage; *II*, the growth impacted in the pylorus and upper duodenum, causing invagination of the stomach into the duodenum. (Matas.)

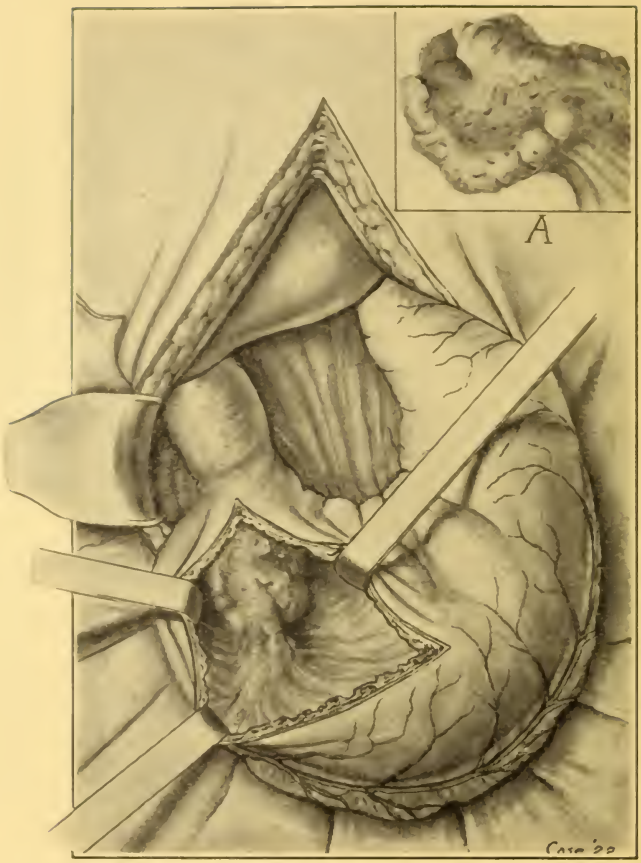

Fig. 2.—Appearance of tumor on opening the stomach after it had retracted from the pylorus (semidiagrammatic). Drawing should show the duodenum more dilated. Insert *A*: Sketch of tumor with part of attached pedicle. (Matas.)

had been exteriorized above the level of the pyloric antrum it was opened right over the mass, immediately above the pyloric antrum, by an incision, 2 inches in length, running parallel with the long axis of the stomach and lying midway between the lesser and greater curvature (Fig. 1). Through this incision the mass was recognized as a pediculated gastric tumor, which, as previously stated, was attached to and grew from the mucosa on a level with the greater curvature and about 5 to 6 inches above the pylorus. The tumor had an attachment to the mucous membrane about 3 cm. in width at its base, tapering into a narrow neck about 1 cm. in width at its attachment to the tumor. The tumor was therefore extremely movable, but it projected into the interior of the stomach like a mushroom (Fig. 1), without ulceration, fungosity or any raw surface whatever. It was merely a growth from the mucosa which rested on a mobile base, freely movable, on the submucous and muscular layers. In consequence of the mobility of its base of attachment the tumor can be easily exteriorized through the incision and its base clamped and crushed with a Payr angiotribe. After this the mass was amputated and the raw surface left on the mucosa was sutured over with continuous silk. This completed the hemostasis and sealed the raw surface left by the excision of the tumor. The incision into the stomach wall was also closed with continuous silk suture for the mucosa and double Lembert for the peritoneum and muscular coats. Before closing, the stomach, pylorus and first part of the duodenum were again palpated and inspected from within, but no signs of ulceration could be detected, only a marked dilatation of the first part of the duodenum, which could be accounted for by the presence of the tumor, which acted not only as a ball valve, blocking the pylorus, but was probably accompanied by an intussusception of the gastric mucosa into the duodenum as the stomach tried vainly to squeeze and rid itself of the tumor. Before closing the abdomen the gall-bladder was palpated and found to be per-

fectly normal, free from calculi and emptying readily on pressure. It was also noticed in replacing the stomach and great omentum that there were several enlarged lymph nodes on the gastroepiploic arch. Nothing further was done except to close the abdominal incision in the usual way, with deep interrupted separate silkworm sutures and the rest of the wound was closed in tiers with catgut. A specimen was immediately transferred to the pathologist, Dr, Lanford, whose report is appended.

A Jutte duodenal tube was left in the stomach, projecting through the nose for the purpose of draining the gastric contents which might accumulate in the stomach by regurgitation from the duodenum through a widely dilated pylorus, and, also, to act as a flue or ventilator to allow the continued escape of gases.

The recovery of the patient was uneventful in spite of his weakened condition, and when discharged, February 22, 1922, the abdominal wound was completely healed. On the day before his departure the urine still showed a faint trace of albumin but no casts; the stools were negative for occult blood; the blood-pressure, 132/88; the total red-cell count was 2,585,000; hemoglobin 45 per cent; color index 0.9; total white cells 5150; differential: Small-8; large-3; neutrophiles-89; anisocytosis; poikilocytosis less marked.*

Pathologist's Report. The specimen is a mushroom shaped structure with edges somewhat irregular. In its longest diameter it measures 6 cm. and other measurements in the same plane are 4½ cm. and 2 cm. At its widest portion it measures 5 cm. and its thickness varies from 1½ to 2 cm. The upper surface is somewhat uneven but velvety in consistency, and of a pinkish-yellow color, relatively uniform throughout. The under surface is of the same general

* It is now one year and six months (June 1, 1923) since this patient was operated, and his reports up to the present time confirm his complete recovery. He has continued to work on his farm without interruption or sign of relapse.

appearance, except that the attached mucosa is relatively loose and gives an impression of being stretched and pediculated by the growth. The under surface also presents a relatively large raw area, in the central portion of which is a firm, fibrous mass or pedicle. The consistency is firm, with the density of the gastric mucosa, but it is uniform throughout. On section it offers little resistance to the knife and presents a cut surface resembling the cut surface of the gastric mucosa, that is, a thick layer of pinkish-gray color, soft and supported by a denser tissue of connective-tissue type. In the upper layer, which is relatively uniform, are noted a few minute spaces filled with mucous material. Gross diagnosis is mucous polypus.

Diagnosis. Adenoma. Histologically benign. Section shows glandular acini of various sizes and shapes, some of which are filled and to a degree distended with fluid. The epithelium is for the most part high columnar and adult in type. The stroma is largely smooth muscle.

Discussion. This observation is instructive in many ways, but its chief interest lies in its diagnostic teachings. Here we have a clear-cut, well-defined, symptomatic picture and a clinical history which, together with the roentgenologic findings, leads to almost certain preoperative conclusions, yet, nevertheless, contradicted by the operative findings. Here we learn that a perfectly benign polypoid or pediculated non-vascular tumor may cause paroxysmal gastric crises characterized by the most intense epigastric pain with vomiting and extreme exhaustion verging on actual collapse. That these crises are accompanied and followed by black, tarry stools (melena), which by frequent repetition led to a progressive and profound secondary anemia, reaching a low hemoglobin ebb of 30 per cent, and a red-cell count of less than 1,750,000. In addition, the radiologic image as seen in series through the screen, and by radiograph, distinctly suggest the presence of a tumor which fills the pylorus, causing obstruction and pylorospasm. While the radiographs, when

looked at in the light of the operative findings, are susceptible of a different interpretation than that which was suggested by the preoperative image, the presumption that the filling defect in the pylorus and duodenum was caused by a malignant growth seemed then to be in harmony with the general conclusions arrived at by the clinician.

With such a symptom-complex and clinical history before us, it is not surprising that a correct preoperative diagnosis should have been missed in this, as in nearly all the cases of this type, thus far reported, in spite of the roentgenologic examination. Is it surprising that, in the vast majority, the diagnosis of malignant tumor or ulcer of the pylorus, with spasm, saddle ulcer, or duodenal ulcer, should have been the predicated diagnosis? Or, again, when there is no occult blood in the feces nor melanotic stools the acute paroxysmal pain in the epigastrium should have been interpreted often as a gall-stone colic, the real cause—a benign pediculated and mobile tumor prolapsed into the duodenum—only coming to light in the course of the exploration? This then is the usual error—the classic error—which has been constantly repeated until very recent times.

On the other hand, the pain, vomiting and pyloric obstruction (filling defect revealed by the roentgen rays), and the periodicity of these gastric crises followed by periods of calm, during which there were practically no digestive disturbances, are all signs and symptoms which, when looked at *a posteriori*, are strikingly suggestive of a mobile, intermittent pathology not in consonance with the continuously progressive history of gastric carcinoma. A different interpretation of the radiographs and of the symptomatology in this case would, no doubt, have been suggested if only the clinical behavior of the polypoid or pediculated benign tumors of the stomach had been more clearly impressed on the minds of the several observers, and the differential diagnosis had not been influenced by the estimate of probabilities in favor of malignant tumor. We can readily

understand the mechanism by which these periodic crises are produced by the traction exercised on the extensible base of the tumor after it has been ejected through the pylorus into the duodenum. Similar cases which exhibit the sequence of pyloric obstruction strangulation and invagination of the gastric mucosa have already appeared in the literature and are strikingly illustrated in the observations reported by Chiari,[1] 1888 (quoted by Ledderhose), Lotsch,[2] Wade,[3] Bland-Sutton,[4] and more recently by Baylac and Dieulafe[5] (invagination in non-pediculated gastric tumors), in which the real pathology was only brought to light by the operative findings.

But the presence of blood in the feces and the black, tarry stools, sufficient to cause a profound secondary anemia, as in this case, is not so easily accounted for by the presence of a simple benign polypus and is truly confusing to the clinician. A cursory survey of the recent and growing literature of polypoid adenomata in particular and of the benign tumors of the stomach in general (of which the pediculated tumors form a very considerable part) shows that bleeding, sufficient to cause a severe anemia—though rarely as grave as in this case—is a frequent accompaniment of these growths whether they be of an intrinsically vascular type (hemangiomata, myoma) or non-vascular (fibroma, fribromyoma or adenoma type). Thus, in a recent study of 27 benign tumors of the stomach observed and operated at the Mayo Clinic, according to Eusterman and Senty,[6] recurrent intestinal hemorrhage was observed as a notable complication in fully 37 per cent of the cases. These observers account for these hemorrhages chiefly by ulceration or erosion of a part of the tumor. But in the present instance the tumor was free from ulceration, erosion or varicosities of any kind. In fact, the tumor showed relatively little vascularity. Even admitting a temporary intussusception of the mucosa of the stomach with partial strangulation during the attacks, it is difficult to conceive of such profuse oozing as to cause tarry stools (which brought

about a state of collapse at the end of each one of the gastric crises) as the result of mere obstructive congestion and strangulation without ulceration.

Of the benign pediculated tumors of the stomach the myomata are notoriously most liable to progressive hemorrhage, behaving in this respect somewhat like the polypoid myomata of the uterus or the submucous fibromyomata of this organ. The gravity of the gastrorrhagias from this source is well shown by Farr and Glenn[7] who in writing of the myomas of the stomach report a case terminating fatally by hemorrhage. That the intestinal hemorrhages were caused in our case by the presence of the tumor (a simple fibroadenoma) cannot be doubted, since the bleeding was completely and permanently arrested with the cessation of the crises after the tumor was removed.

The repeated attacks of pain, the hemorrhages, exhaustion, occurring at frequent intervals, and loss of weight continued to direct the attention of the clinician to the more common and vastly more frequent occurrence of malignant disease of the stomach as the more probable diagnosis. This probability was seemingly confirmed by the roentgenologic findings, and all these facts combined tended to deviate the observer's thoughts from the rare benign tumors, whether pediculated or sessile, which are coupled only in a vague hypothetic way with such grave manifestations as were displayed in this case. *It is the failure to realize that a benign and especially a pediculated tumor in the stomach may assume a very malignant aspect ending in death—that is largely responsible for the little attention that is given to these tumors in scanning the differential diagnosis.* The fact that benign tumors of the stomach are statistically rare as compared with the malignant have made them a negligible factor in the estimate of probabilities in cases clouded with obscure or contradictory evidence. Eusterman and Senty, previously quoted, reported a total of 27 benign tumors of the stomach observed in the Mayo Clinic between 1907 and 1921. "During this period operation had been performed on 2146 patients with cancer

of the stomach, on 20 with sarcoma and on 2 with malignant polypus of the stomach, a total of 2168. The proportion therefore, of malignant new growths to benign new growths is 78 to 1 *i. e.* 1.3 per cent of all gastric tumors are benign. But this proportion in our experience is only relative, for, during the same period, 2285 additional cases of malignant gastric neoplasms, the majority of them inoperable, passed through the clinic." The actual proportion of benign new growths to the malignant new growths or ulcerations they estimate to be 1 to 200.

While the relative infrequency of the benign tumors of the stomach shown by these and other statistics is fully recognized, the surgeon should not be too hasty in attributing to cancer all the manifestations of the advanced gastropathies in which intermittent or periodic epigastric pain, tumor, vomiting, intestinal hemorrhage and anemia, with radiologic evidence of pyloric stenosis and spasm, play a prominent part.

In all cases a thorough sifting of the clinical evidence, especially the occurrence of gastric crises at periodic intervals, after which the stomach enters into a stage of calm, should suggest a most careful and repeated study of the roentgenologic image with the view of differentiating the polypoid or pediculated tumors which offer more distinctive characteristics and are more frequently benign and operable. That a preoperative diagnosis of these polypoid or other benign growths, especially if pediculated, is possible with the aid of the improved roentgen ray technic of the present day, is shown by the case reports and contributions of Myer (1913),[8] Stoner (1914),[9] and Basch (1916),[10] Carman (1918),[11] Balfour (1919),[12] and Eusterman and Senty (1922) of the Mayo Clinic; Holmes,[13] of Detroit (1919) (pediculated malignant growths), Pendergrass and Pancoast (1920),[14] Ruggles (1920),[15] Merrill (1921[16] and others in this country. Differential preoperative diagnoses based on the radiologic evidence are reported in the foreign literature by Heinz (1911),[17] Konjetzny (1919–1920),[18] Geymüller (1919),[19] Gassmann (1921),[20] Lieblein (1921),[21] Paus,[22] of Christiania, Ledderhose[23] and others.

While these observers have recorded diagnoses that were more tentative than positive, they are in several instances stated by the roentgenologist independently and in opposition to the clinical diagnosis, showing that in each instance there were reasons derived from the appearance of the radiographs to justify a doubt as to the diagnosis of malignant disease in favor of a benign tumor, especially when these were polypoid or pediculated. Gassmann, who has recently (1921) written more specifically upon the roentgen diagnosis of gastric polypi, states that "the fact that a pediculated polypus of the stomach can be diagnosed radiologically is not without practical significance. In some cases operation for carcinoma of the stomach prolongs life, but in the majority of instances it shortens it. If the case which he (Glassmann) reports had been diagnosed as carcinoma he would have hesitated to operate. When it was decided that the growth was probably a polypus it was clear that an operation was necessary to prevent death from bleeding." The operative findings confirmed the roentgen-ray diagnosis and the patient recovered. Eusterman and Senty are right when they state: "Often patients with benign gastric tumors are refused operation because the condition is regarded as malignant and inoperable. The true nature of the lesion is only discovered when the patients insist on operation." The one salient fact that comes out of this discussion and that is to be retained by the surgeon in approaching a surgical gastropathy is that the most perfect clinical picture of cancer of the stomach may be imitated even to a fatal issue by a perfectly operable benign growth.

The low mortality and excellent surgical end-results obtained by extirpation of benign polypoid tumors, which are reported by nearly all observers, would justify at least an exploration in doubtful cases, even in the seemingly desperate and forbidding circumstances related in this case.

Supplementary Addendum. The term "polypoid adenoma" is applied in this observation in a qualifying sense to mean simply a pedunculated tumor. Pediculation or pedun-

culation is an anatomical peculiarity which is common to many tumors. In the gastrointestinal tract, this mode of attachment may be exhibited by nearly all the benign tumors, such as the lipomas, fibromas, myomas, fibromyomas, lymphangiomas, hemangiomas, etc., and also, but rarely, by the malignant tumors which may grow on a primarily benign pediculated tumor or develop secondary mobile attachments. At one time, before the histologic differentiation of tumors had made as much progress as it has today, all pendulous tumors attached to or hanging from, mucous surfaces were described as mucous polypi; but at present the term is restricted to the pediculated tumors of a specific histologic type, namely, the *adenomata*, when the growth imitates the glandular epithelium of the gastric mucosa, and to the *papillomata*, or mucous wart, which imitates and reproduces the normal surface epithelium.

In this instance we are using the term polypoid in a broad, generic sense to indicate a benign, movable tumor attached by a stem, stalk or movable base to the surface of the gastrointestinal mucosa. I lay stress on this point, as I believe that the pediculation of a tumor of the stomach gives it a distinctive clinical and diagnostic physiognomy which differentiates the polypoid or pediculated tumors as a class, from the sessile or non-pediculated growths which are more often malignant.

When gastric tumors are pediculated they are mobile and the range of excursion varies with the length of the pedicle and the mobility of the base of attachment, some pedicles measuring only a few millimeters and others 12 cm. or more in length. The base of attachment is also movable according to the nature of the growth and of the surface to which it is attached; the attached mucosa may slide freely on its submucous and muscular layers, yielding readily to traction and thus increasing the length of the pedicle to a very great extent, as in this instance and in many other cases. In some instances the whole wall of the stomach may be dimpled, inverted or invaginated at the point of attachment of the pedicle,

provided sufficient traction is exercised by the tumor. It is in virtue of this traction on the pedicle of polypoid tumors that intestinal obstruction occurs so frequently from invagination and intussusception. Where a tumor of the stomach is pediculated it is easy to conceive the mechanism by which it may cause sudden attacks of pyloric obstruction of a paroxysmal character with pylorospasm and pain of great intensity which may subside, to be followed by variable periods of calm. A pediculated, mobile tumor attached to the mucosa will act as a foreign body which the stomach will endeavor to eject through the pylorus. It will act in this way as a *ball valve* which will obstruct the pyloric ring or block the duodenum. The tumor itself may be large enough to block the pylorus or duodenum, but even a relatively small tumor may, by traction exercised by its pedicle on the gastric mucosa, drag this into and beyond the pyloric ring, thus not only completely obstructing it but favoring partial invagination of the stomach into the duodenum, thereby giving rise to the symptoms of strangulation as well as of obstruction.

This would constitute the *crisis*, or attack, in which, as in this patient's case, intense, agonizing pain in the epigastrium, with vomiting and collapse, followed by tarry stools and progressive anemia, were the outstanding symptoms. When the pyloric and duodenal spasm relaxes the symptoms subside and the patient enters into a period of calm which will vary in duration according to many circumstances. The tumor may be released from the pyloric grasp and retract into the stomach, where it may continue to roll about. Or it may lie quiescent in the relaxed duodenum, as in this case, until the continued effort at propulsion may drag the attached mucosa to the pylorus, there to undergo a repetition of the same herniation and strangulation. It is important to remember that these attacks may recur at *irregular* intervals regardless of the meal time or the quantity or quality of food.

The paroxysmal or intermittent character of these attacks, in which the period of violent suffering and collapse is followed by a stage of complete or relative calm, is a striking

feature which is eminently suggestive of a "ball valve" pediculated tumor even when "occult blood" and tarry stools (melena) with progressive anemia add a graver cast to the clinical picture.

To direct the attention of surgeons to the nature and periodicity of these crises and their diagnostic significance from the clinical point of view is the main purpose of this paper. To synthesize the radiologic observations which have already accumulated in the literature of the last few years in a way that would stamp the distinctive features of the polypoid (pediculated) from the non-pediculated tumors and to separate the benign from the malignant, is indeed a worthy task which however, I can only touch upon in this brief communication.

[NOTE.—No attempt has been made in this discussion to treat *pediculated gastric adenomata* systematically. The literature is now rich in monographic essays which have steadily accumulated since the classic paper of Brissaud (1885) and Menetrier (1888). Nor has any attention been given here to the rarest but most interesting type of multiple polyadenomatous polyposis *en nappe* or in plaques,—which presents very distinct differential clinical and roentgenological characteristics. No mention has been made of a number of solitary pediculated polypi of the ball-valve type, which have been recognized at operation and successfully removed, as in the cases reported by Doyen (1895), C. L. Gibson (1907), J. A. Blake (1907), E. Novak (1920), N. Rankin (1921) and others, which are almost counterparts of the present case in the anatomical, pathological and operative details, but which differ very notably from the present instance in the lack of grave clinical syndrome herein described.]

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HUGH McGUIRE TAYLOR, M.D.

IN MEMORIAM.

HUGH McGUIRE TAYLOR, M.D.

1855–1922

Hugh McGuire Taylor, son of Major William Taylor and Gertrude McGuire, his wife, was born November 11, 1855, at "Springsberry," the home of his father, in Clarke County, Virginia.

Dr. Taylor's early education was obtained at the Academy in Berryville, his native county-seat, and at the Virginia Military Institute. He began the study of medicine in Richmond in the office of his uncle, Dr. Hunter Holmes McGuire, noted first as medical director of Stonewall Jackson's army corps, and later as a leader in surgery and Southern medical education. Dr. Taylor graduated in medicine at the Medical College of Virginia in 1876. He married Miss Mary Edmunds Whitcombe, daughter of the late Colonel Henry D. Whitcombe, of Richmond.

After receiving his degree, Dr. Taylor was appointed demonstrator of anatomy in the Medical College of Virginia, and later, upon the organization of the University College of Medicine, was elected to the chair of practice of surgery in that institution. When the two Richmond schools were merged, in 1913, Dr. Taylor was elected professor of practice of surgery in the consolidated school, and continued actively to teach for several years.

His service to his profession was a broad and diligent one. He was a member of the Virginia State Board of Medical Examiners when that body first was organized, and as secretary, later as president, helped to shape its policies. He was president of the Richmond Academy of Medicine and Surgery, vice-president of the International Association of Railway Surgeons, president of the Medical Society of Virginia, Fellow and a Founder of the Southern Surgical Association, member of the Southern Medical Association and the American Medical Association.

As a surgeon, he was skilful and under all circumstances cool and resourceful. Deliberate in judgment, he would pursue with serene courage the course he believed to be right. In abdominal surgery, especially in perforations due to typhoid fever, gastric and duodenal ulcer, he did pioneer work. His sincere regard for the welfare of his patients endeared him to a large clientèle not only as surgeon but also as friend. He was long a member of the vestry of All Saints Parish, Richmond, and was as devoted in his service to his Church as to every interest that commanded his loyalty.

Dr. Taylor was widely known. Many of his old students will best remember him as a teacher, for in teaching he excelled. Daily engaged in the problem his students were preparing to face, practical in his nature and keenly alive to his responsibility, his precepts were driven home with indelible force and his surgical maxims are still remembered by those who sat under him. But with those who knew him in his own home, it is the man who best is remembered. Shrewd in his understanding of human nature, no one was more willing to throw over human failings the mantle of charity. To the younger members of his profession he was sympathetic and helpful. With respect to his contemporaries, he was ever readier with a word of praise than of blame.

Too young to serve his state in the War between the

States, he yet remembered clearly the time when the valley of the Shenandoah was the battleground of the contending armies, and could talk interestingly of his boyhood recollections. But few there were who knew how keenly he desired to serve his country in the late war. Declined by the government for active service on account of his age, he continued to do his duty in private practice, and as referee for the local examining board until the Armistice, which came on his sixty-third birthday.

Forced by ill-health to give up active practice some two years before his death, Dr. Taylor spent his last days in calm enjoyment of his family and friends at his home, "Whitcombe," near Richmond, and at "Springsberry." At "Whitcombe," he died May 31, 1922, in his sixty-seventh year, survived by his wife. His remains were laid to rest in Hollywood Cemetery.

In action and speech he was gentle; in feelings, modest and kind; in judgment, charitable. He loved the flowers, which none knew better than he how to grow; he loved the birds which made his place their home; and he loved his friends.

WILLIAM EDWARD McGUIRE, M.D.

WILLIAM EDWARD McGUIRE, M.D.

1860–1921

Dr. William Edward McGuire was born at "Norwood," near Berryville, Va., in 1860. His death occurred at his home in Richmond, Va., on October 6, 1921.

Dr. McGuire was descended from a long line of distinguished ancestors, among whom were many prominent physicians. He was the son of Dr. William David and Nancy Moss McGuire. His father was a widely known and distinguished physician in the Valley of Virginia.

The early years of Dr. McGuire's life were spent at "Norwood," his father's farm. He received his first schooling at home, and later attended the Berryville Academy.

He remained there until he was seventeen years old, but was then compelled to leave on account of his father's death.

In 1885, Dr. McGuire entered the medical department of the University of Virginia. The medical course at that time consisted of two years' study, but in spite of sickness and other handicaps he managed to complete the two years' work in one session and graduated in the spring of 1886.

The following year, Dr. McGuire served an internship at old St. Luke's Hospital in Richmond, Va., then conducted by his cousin, the late Dr. Hunter McGuire. For several years thereafter he was associated with Dr. Hunter McGuire in his office and general practice.

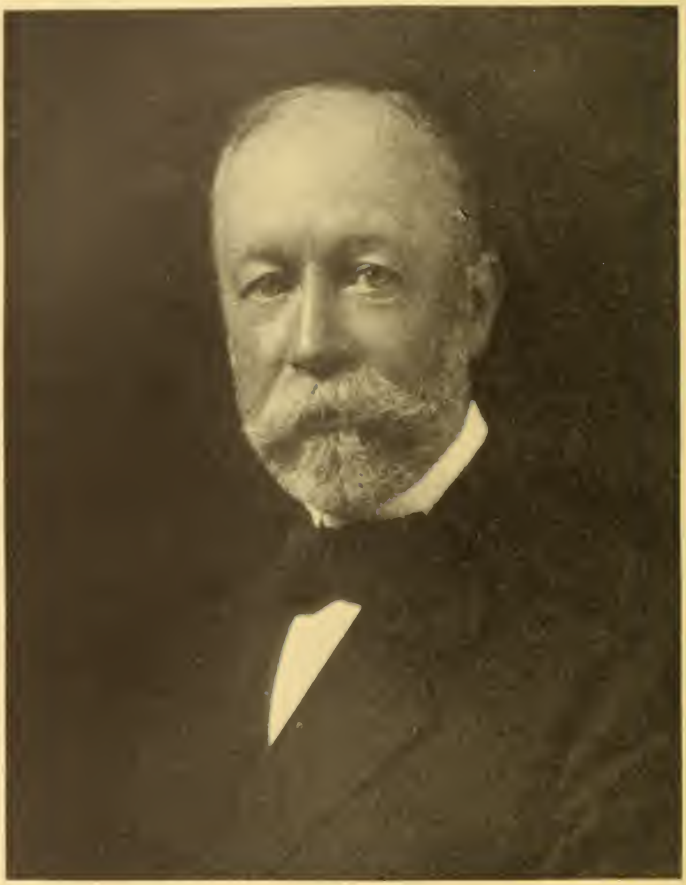
Early in his professional career, Dr. McGuire practised both surgery and general medicine. In the later years of his life, though he never gave up his family practice, he became noted as an internist and diagnostician.

Dr. McGuire occupied the chair of gynecology from 1894 to 1911 in the University College of Medicine at Richmond, Va. He was professor of clinical medicine in the same institution from 1911 to 1913. After the consolidation of this school with the Medical College of Virginia, he was again elected professor of clinical medicine and served in this capacity until 1917. He then resigned on account of his failing health.

He was a member of the State Board of Health of Virginia, of the Volunteer Medical Service of the United States Army, a Fellow in the American College of Physicians, a member of the International Gastro-Enterological Association and of the American Therapeutic Society, as well as many other organizations. He was elected a Fellow of the Southern Surgical Association in 1891.

In 1894, Dr. McGuire married Mary Stuart McGuire, a daughter of the late Dr. Hunter McGuire. He is survived by her, a sister and one son.

It is to the character and personality of Dr. McGuire that tribute should especially be paid. Many men have been successful practitioners and scientific physicians, but in addition to this, Dr. McGuire was a man of sound judgment, firm convictions and possessed moral courage of high degree. He maintained the admiration and respect of everyone with whom he came in contact, but above all it was his interest in others and his unselfishness that caused him to be beloved by all his patients and friends. It was said of him after his death by the editor of one of the Richmond newspapers that "No man in his generation has been more loved in Richmond than Dr. Edward McGuire."



WALTER BREWSTER PLATT, M.D.

WALTER BREWSTER PLATT, M.D.

1853–1922

Dr. Walter Brewster Platt was born in Waterbury, Conn., December 20, 1853. He was the son of Gideon Lucian and Caroline (Tudor) Platt. His father was a physician and surgeon and president of the Connecticut Medical Association.

Dr. Platt received his early education at Williston Seminary, East Hampton, Mass., going from there to Yale University and receiving his Ph.D. in 1874. He then went through the course at the Harvard Medical School, and after graduating there spent some months in Europe, where he took postgraduate courses in medicine at the Universities of Berlin, Vienna and Heidelberg. One of his teachers was Prof. Langenbeck. He became a member and later a Fellow of the Royal College of Surgeons in England.

In 1878, he was assistant to the superintendent of the Boston City Hospital and afterward house surgeon there. He began practice in Baltimore in 1881, was surgeon to Bay View Hospital for about five years and during that time was demonstrator of surgery at the University of Maryland. From 1886 until the time of his death, he was superintendent of the Robert Garrett Hospital for Children.

About twenty-eight years ago, Dr. Platt, while operating on a child, infected his finger; the infection rapidly extended and for a time threatened his life. For the last six or seven years of his life he suffered from high blood-pressure and for two years from a cardiac affection. He died on October

30, 1922, leaving a widow, Mary Washington Perine, a direct descendent of George Washington; two sons, Washington and David Perine, and a daughter, Mrs. Charles Chauncey Hall. One son, Lieut. Lucian Platt, of the Engineering Corps, died of influenza at Camp Humphrey. Dr. Platt himself during the war insisted on doing his share and was stationed at Wilmington, Del. at the Du Pont Works.

Dr. Platt, besides being unusually well informed in general medicine, was conspicuous for his broad grasp of the fundamental problems of life. He not only inspired complete confidence in his patients, but also won their admiration and affection. His outstanding quality was his optimism. This was ever manifest, and obstacles never seemed to worry him. He often said that he would like to live to be a thousand—life was so full of interest. He was absolutely fearless in expressing his opinion as to what he deemed right and just. He was buried in Greenmount Cemetery, Baltimore, Md.

In the passing of Walter Brewster Platt, his many patients have lost not only a careful, conscientious and excellent physician, but also a true friend; we of the medical profession lament a member who ever sought to uphold the best traditions of our craft.

T. S. C.

WILLIAM PHILLIPS CARR, M.D.

WILLIAM PHILLIPS CARR, M.D.

1858–1921

William Phillips Carr, son of William B. and Laura (Phillips) Carr, was born at Boydton, Va., May 10, 1858.

He was educated at Leesburg, Virginia, Academy, 1870–74; at the Randolph-Macon College, Virginia, 1874–76, and in medicine, at George Washington University, from which he received the degree of M.D. in 1888.

He then served in his Alma Mater as follows: Prosector of anatomy, 1888–89; demonstrator of anatomy, 1890–95; professor of visceral anatomy, 1891–95; of physiology, 1894–96; of surgery, 1906–08, and associate surgeon in its hospital, 1898–1908. He was attending surgeon in the Emergency Hospital, 1895–1921, and was a consulting surgeon to Washington Asylum Hospital and Government Hospital for the Insane, 1898–1916.

He was a member of the Medical Society of the District of Columbia, of the American Association of Anatomists, of the American Association for the Advancement of Science, of the Washington Academy of Science, of the Washington Obstetrical and Gynecological Society, and a Fellow and Founder of the American College of Surgeons and Fellow of the American Medical Association. He was a Fellow of the Southern Surgical Association from 1903 to the date of his death, December 27, 1921, at Summit Point, West Virginia, whither he had gone in quest of relief from a severe heart lesion.

Dr. Carr was indefatigable in his efforts to establish and

maintain the Emergency Hospital, was a frequent contributor to medical literature, several of his papers having been read at meetings of this Association. He was a man of strong convictions, and imagination was highly developed in him. Nor was his talent limited to medicine, for he has shown marked skill with his brush and pencil. His was a genial disposition and secured for him a wide personal friendship. In 1883, he married Miss Georgia O. Carter, of Hamilton, Va., and is survived by two sons, Dr. William B., of Warrenton, Va., and Edward R., of Washington, D. C.

J. Wesley Bovée.

WILLIAM R. JACKSON, M.D.

1864–1922

Dr. William R. Jackson, Fellow of the Southern Surgical Association, died at his home, in Mobile, Alabama, July 3, 1922.

Born in Nacogdoches County, Texas, June 16, 1864, he graduated at the University of Texas and received his medical degree from the Medical Department of the University of Alabama in 1887. He practised medicine and surgery in Mobile up to the time of his death.

He served as professor of surgery in the Medical Department of the University of Alabama for the last thirty years of his life. For a number of years, he was a member of the State Board of Examiners and a member of the State Medical Board. He was a member of the local, State, and American Medical Associations; a member of the Southern Medical Association, and a Fellow of the the American College of Surgeons. H. P. C.

ERNEST KEYS CULLEN, M.D.

ERNEST KEYS CULLEN, M.D.

1878–1922

Ernest Cullen was born in Belleville, Ontario, May 14, 1878. His father, Thomas Cullen, who was born in the county of Fermanagh, Ireland, and who came to Canada in childhood, was a well-known Methodist minister. His mother, Mary Greene, was born at Penzance, Cornwall, England. Her father came to Canada in the early forties as a Bible Christian missionary.

Cullen attended the public schools in Toronto, Sarnia, and Aylmer, and then went to the high school at London, Ontario. Later he went to the Parkdale Collegiate Institute in Toronto. During the summer vacations, while in the high school, he was employed on one of the large steamers plying between Detroit, Mich., and Duluth, Minn., and in the course of his summer labors crossed lakes Huron and Superior sixty-four times.

In the fall of 1899 he entered the medical department of Toronto University. During the summer between his first and second years he spent his time in the pathological laboratory of the Johns Hopkins Hospital, familiarizing himself with the laboratory routine. The following summer was also spent at the Johns Hopkins Hospital, working in bacteriology with Dr. Norman MacL. Harris.

During the summer vacation of 1902 he worked on the morphology of the blood of fishes and birds. This investigation was carried on at and near Chester, Nova Scotia, under the direction of Dr. Charles E. Simon, of Baltimore. It formed the basis for a subsequent paper on the subject.

Ernest Cullen graduated in medicine from the Toronto University in 1903 and at once came to Baltimore, where he was made assistant in medicine in the Johns Hopkins Hospital dispensary. During this year he devoted special attention to general medicine, to diseases of the skin and to the genito-urinary work in the male. The following year, 1904–05, he was one of the house surgeons in the Toronto General Hospital. He again returned to Baltimore and was made fellow in pathology with Prof. William H. Welch. This position he held for the year 1905–06.

The year 1907 was spent in helping Dr. Howard A. Kelly and Dr. Cullen's brother, Thomas, in gathering together and analyzing myoma cases for the book they had in progress. Much of the success of Kelly and Cullen's *Myomata of the Uterus* was due to the indefatigable labors of the younger Cullen. He also helped his brother materially in his work outside the hospital. In 1908, Cullen became assistant resident gynecologist on Dr. Howard A. Kelly's service in the Johns Hopkins Hospital. This position he held for two years, and in 1910 he was made resident gynecologist to the Johns Hopkins Hospital. This position he held for the usual year.

In 1911, Ernest Cullen located in Detroit, Mich., and soon became associated with the Detroit Medical School, where the late Benjamin Schenck, a Johns Hopkins Medical School graduate, was doing such fine work. Cullen taught not only in the clinical side of gynecology, but also gave the course in gynecological pathology. After Schenck was forced to relinquish his position, on account of illness, Cullen undertook much of his teaching, and each year his private work increased.

In the spring of 1917 came the call, and he immediately joined the Harper Hospital unit (Base Hospital 17), with the rank of captain. Harper Hospital unit was located at Dijon. He spent most of his time with the unit, but for a certain period was sent up to the front line with the British. He

returned to America in the spring of 1919 with the rank of major and again took up his professional labors in Detroit, Mich.

In June, 1921, Dr. J. Henry Carstens, president of the faculty, head of the department of gynecology and professor of abdominal and pelvic surgery in the Detroit College of Medicine and Surgery, and who was well known and beloved not only by the profession but also by the citizens of Detroit, Mich., was not feeling well. One day he wearily climbed the steps to the medical school and told the dean that he would like to make a note in the official book. In August that splendid man died of cancer of the mediastinum. In October the medical board met to elect his successor. The dean, remembering that the old war-horse had made a note in the book, opened it at that point and showed it to each member of the board. The note in effect was as follows: If I am not able to take up my school work in the fall, I would respectfully ask that you appoint . . . . in my place. No member of the board spoke for several minutes. Then one in a husky voice moved that Dr. Carstens' request be complied with. Another in an equally subdued voice seconded the motion, and it was unanimously carried. The name suggested by Dr. Carstens was Ernest Keys Cullen. Accordingly, in 1921, Cullen became professor of gynecology in the Detroit Medical School.

The school year 1921–22 was a heavy one and the organizing of the gynecological work in the new receiving hospital took a great deal of his time, so that by the end of the school year he was rather tired out.

On July 3, 1922, he was eagerly looking forward to a well-earned vacation, and had his railroad tickets in his pocket. After a very heavy day's work, and just as he was about to leave his office, he beckoned to his associate, Dr. H. P. Cushman. Cullen looked very pale and almost immediately vomited seventy ounces of blood. He was removed to the hospital at once. On the following day he was better,

but on the morning of July 5 bleeding started up again, and notwithstanding transfusion after transfusion he died that evening. The only premonitary sign of any kind was the vomiting of 2 ounces of blood a couple of weeks before. After the first severe hemorrhage Cullen himself suggested varices. At least a dozen of his colleagues dropped all their work and stood by him to the end. At no time was he in fit condition for operation. At autopsy varicose veins of the esophagus and cardiac end of the stomach were found. Three of these had ruptured. There was a beginning non-alcoholic cirrhosis of the liver. No operation would have been of the slightest value.

Cullen published twelve papers. A glance at the accompanying bibliography will show that they cover a wide range and that they are most instructive. At the time of his death, Cullen was not only professor of gynecology in the Detroit Medical School, but also chief of the gynecological department of the Harper and of the Receiving Hospitals and consulting gynecologist to St. Mary's Hospital.

He was a member of the Wayne County Medical Society, Michigan State Medical Society, American Medical Association, Detroit Surgical Society, Detroit Urological Society, American Association of Pathologists and Bacteriologists, Southern Surgical Association, American College of Surgeons, Detroit Academy of Surgeons and the American Legion.

On April 28, 1920, Dr. Cullen married Miss Myrle Macklem, of Marlette, Mich., who served as a nurse with the Harper Hospital unit. He is survived by his widow and an infant daughter, Charlotte Mary Cullen.

Ernest Cullen had had a broad preliminary training. He was a careful, conscientious surgeon, whose good judgment and faithful work had made him an outstanding figure in Detroit. He was generous to a fault and was beloved by all. Everybody called him "Ernie Cullen." Such a gloom existed at Harper Hospital on the day following his death that no one had the heart to work; every operation was cancelled.

The resolution of the Medical Board of the Harper Hospital, as published in the *Harper Hospital Bulletin*, gives a clear idea of the excellent work he had done there:

"In the passing of Dr. Ernest Keys Cullen we feel that Harper Hospital has lost one of its ablest leaders. Because of his unusual professional training, his organizing ability, his pleasing personality, he was able to build up a department which occupies first place among the departments in this institution. To him is due the credit of instituting the present resident system, which has proven so satisfactory and which has already given this community a number of well-trained men in this special field of work.

"Dr. Cullen was respected by every member of the hospital staff. The deep grief shown by all at his untimely death was eloquent evidence that each man felt a personal loss.

"His intense interest in all medical matters that meant for progress, his activity in intern teaching, his participation in instruction of our nurses, makes his absence at this particular time most keenly felt by all. Harper Hospital will long feel the loss sustained by his death."

The *Bulletin of the Wayne County Medical Society*, the official organ of the medical profession of Detroit, Mich., says: "Dr. Cullen served during the World War with Harper Hospital unit. He was one of the most valuable and popular men of the organization. His perseverance, thoughtfulness and sincere devotion to the American soldiers were marked characteristics of his work. Removed from our midst at the height of his usefulness, his untimely taking off is deeply deplored by the profession and a vast number of friends. He will be greatly missed."

Ernest Keys Cullen's remains rest beside those of his father, his mother and his sister Lilly in Mount Pleasant Cemetery, London, Canada.

To few men has it been granted to accomplish so much and to leave such a fragrant and lasting memory at forty-four years of age.

On December 14, 1922, a memorial service was held for him at Dijon, France, presided over by the general commanding the district. An American hymn was played, a sketch of Dr. Cullen was read and his photograph was thrown on the screen, while the whole audience stood at attention for five minutes—a very unusual tribute to one who died several years after the war.

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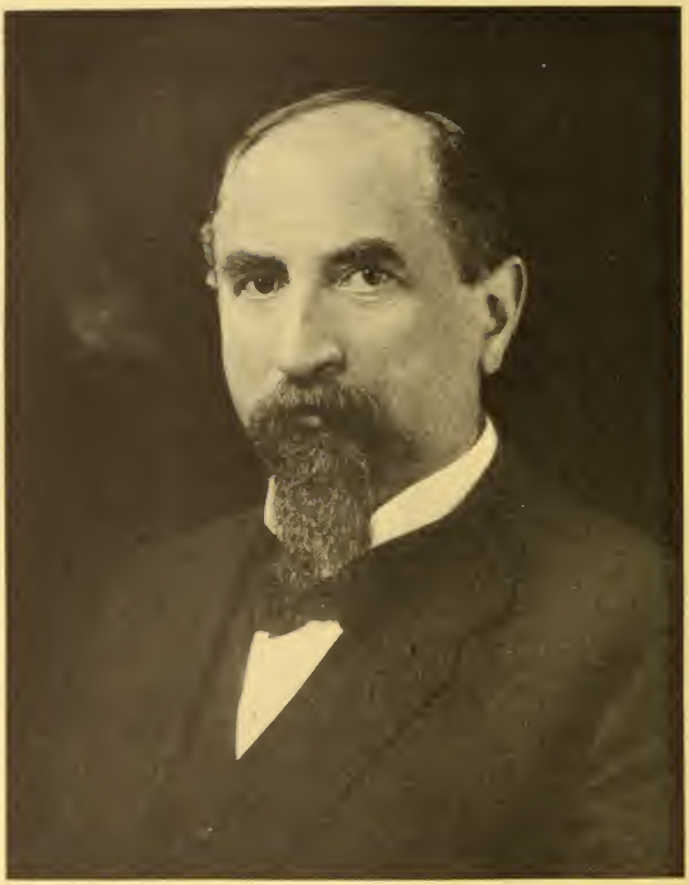


HERMAN TULHOSKE, M.D.

HERMAN TUHOLSKE, M.D.

1848–1922

WITH the passing of Dr. Herman Tuholske in June, 1922, after more than fifty years of medical service, Missouri lost one of her last remaining pioneer surgeon-teachers.

Son of Johanna Arnfeld Tuholske and Newman Tuholske, a teacher of Prussia, one of several children, he had the benefit of the classical education of the Gymnasium and then followed an older brother to America, reaching his destination in St. Louis with his funds so low that he chose to spend what time was left the night of his arrival walking about the streets of the strange town rather than draw on almost his last dollar for a night's lodging.

Having tried with lessening enthusiasm to read law in the office of an old friend of the family in Illinois, he returned to St. Louis and by dint of greatest effort managed to keep going, at one time teaching in a private school, where both the principal and he did janitor duty out of school hours, until he was finally able through the trust and consideration of the head of the faculty, to matriculate as a student in the Missouri Medical College. Upon completion of the course, which he followed (quite unbeknown to his family) with intense ardor, he was made demonstrator of anatomy and later professor of surgery and member of the faculty. Thenceforth for the best years of his life he gave his finest energy to surgical teaching. He presented his material with such clarity, power and enthusiasm that the constantly increasing classes of students from Missouri and the

Southwest left his ampitheater thrilled and inspired with passion for their profession.

In his teaching in classroom and clinic Dr. Tuholske found his fullest, freest expression, his deepest satisfaction. Nothing gave him greater joy throughout the years of his busy life as a successful surgeon than the visits of "his boys" from many states. Small of stature, keen of eye, indomitable of will, warm of heart—the power and magnetism of his personality dominated wherever he might go.

No physician ever inspired greater confidence and love in myriads of patients of all estates. They worshipped him as a god. With his entrance into the sickroom doubt fled, courage came. Strength radiated from him. His mere presence worked wonders upon the spirit of the sufferer.

The history of his professional career is inseparable from the history of medicine in the Middle West. He served as head of the St. Louis Quarantine Hospital during the severe smallpox epidemic of 1872 and as city dispensary physician from 1870–75 enlarging the department and instituting a day and night ambulance service. Later his tri-weekly surgical clinics at the City Hospital were for years the favorite gathering place of eager students.

In the meantime to continue his own medical education he had made study trips to the Continent, remaining in Vienna for six months of concentrated work in 1886. Here he met and studied with von Eiselsberg, under Billroth, an association treasured always by both surgeons.

Besides his St. Louis City Hospital affiliations, Dr. Tuholske was connected at one time or another, as surgeon or consultant with the Mullanphy Hospital, St. John's and the Martha Parsons Free Hospital for Children. In 1890 he established his own private surgical and gynecological hospital, which he gave up after a decade of increasingly successful work in order to head the St. Louis Jewish Hospital. He was of the first to fight for the three-year term medical college course in Missouri, and as a member of the Faculty

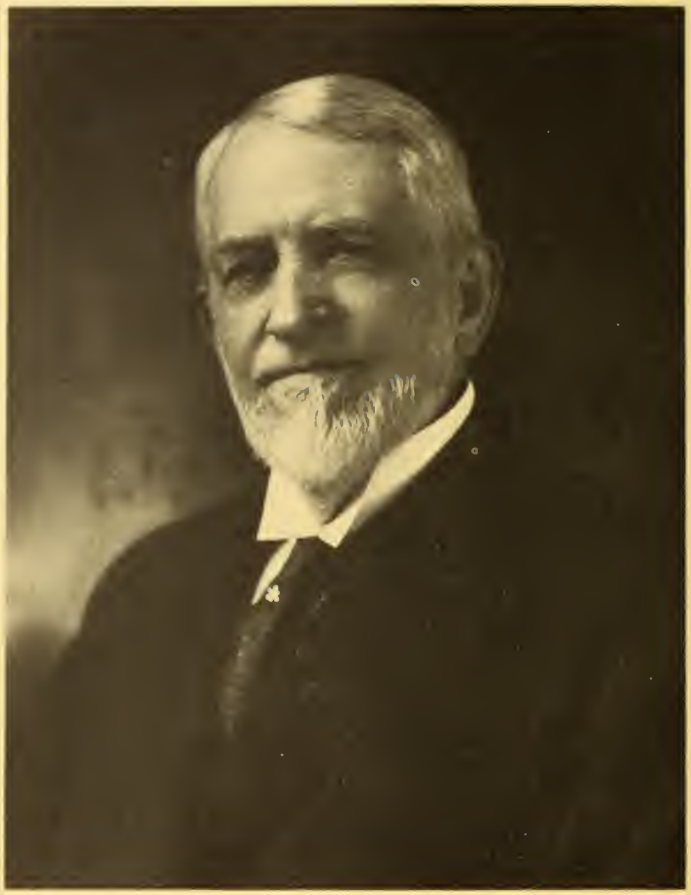
of the Missouri Medical College brought about its union with the St. Louis College to form the Medical Department of Washington University. He was appointed Professor of Surgery in the Washington University School of Medicine.

Dr. Tuholske served as president of the St. Louis Medical Society. He was a Fellow of the American College of Surgeons. He earnestly treasured his connection with the Southern Surgical Association and deeply regretted his inability to attend many of the more recent conventions owing to the condition of health of his wife.

After the death of his wife, Sophie Epstein Tuholske, in 1918, he himself was broken in health, and in May, 1922, during the St. Louis Convention of the American Medical Association, was no longer able to welcome the many who came to seek their former beloved teacher. On that occasion it so happened that a convention member, himself by no means young, presenting himself at the information desk, assured the lady on duty (by chance Dr. Tuholske's daughter) that he had come mainly to "once more shake the hand of Dr. Tuholske." Death came quietly a few weeks later. Dr. Tuholske is survived by a daughter, Mrs. Ernst Jonas, and a son, Dr. Lister Tuholske.

In the scientific world Dr. Tuholske will be remembered nationally and internationally as a pioneer in surgery. He was of the first to record successful ovariotomies and to develop simultaneously with Dr. Bull a new method of stomach resection. He made valuable contributions to medical literature. In his City, State and the Southwest he will be remembered as a skilled surgeon, a great physician, a man of broad sympathies. His was a compelling personality in the pioneer period of strong individuals. In the hearts of his patients, his students, his colleagues, his fellow-citizens, his memory remains a living inspiration.

ERNST JONAS.



RICHARD BROOKE MAURY, M.D.

RICHARD BROOKE MAURY, M.D.

1834–1919

Dr. Richard Brooke Maury was born in Georgetown, D. C., February 5, 1834, and died at the age of eighty-five in Memphis, Tenn., March 17, 1919. He was of an old French Huguenot family, whose most distinguished American member was the well-known oceanographer, Lieutenant Matthew Fontaine Maury.

Dr. Maury was graduated in medicine from the University of Virginia in 1857, and the following year from the University of New York. Though he did not receive an academic degree, he was singularly gifted as regards general education, not only in the matter of history and literature that are familiar to many who are of studious tastes, but in languages and mathematics, besides the subjects more closely pertaining to his professional work. During his student days in New York he had pulmonary hemorrhages, and was advised by his teacher and life-long friend, Dr. John Metcalfe, to go South for his health. Dr. Metcalfe sent him to some of his own relatives, near Natchez, Miss., who took Dr. Maury into the home as one of the family until his health was restored. He then settled in Port Gibson, Miss., where he practised until the outbreak of the Civil War, when he was commissioned as surgeon, with the rank of major, of the Twenty-eighth Mississippi Cavalry.

At the conclusion of the war, marked for him by an arduous service, most of it with troops, he moved to Mem-

phis in 1867. Shortly therafter he was invited by Dr. Robert Mitchell to associate himself with him in the practice of medicine, an invitation which a brief investigation showed Dr. Maury the wisdom of accepting. The firm of Mitchell and Maury, then formed, engaged in the active practice of medicine for nearly forty years, years of usefulness and of public service rewarded by the greatest respect and confidence of their fellow citizens. When the association was dissolved, by the retirement from active work of its two members, there was no lessening of that mutual admiration and high regard that had existed between them for their years of companionship. In 1885 Dr. Maury, who was giving more and more attention to the diseases of women, opened a small private hospital, and the following year he and Dr. Mitchell erected a suitable building for the conduct of this special work. Dr. Maury also founded the Woman's Hospital later and still known as the Lucy Brinkley Hospital, in memory of the wife of its chief benefactor. From a small out-patient department, this developed into a splendid institution capable of caring for nearly a hundred patients.

In 1904 Dr. Maury retired from the active practice of medicine, but was always available for the needs of his old friends and patients. Such a mind and such a nature could not be idle, and after his retirement he was instrumental in founding the City Club in 1907, which for a time conducted a Bureau of Municipal Research, the West Tennessee Audubon Society in 1911, and the Recreation Commission in 1914. In this year, on his eightieth birthday, he was tendered a complimentary banquet and presented with a loving cup by his professional friends, nearly all the physicians of Memphis being present and his friends from a distance represented by many congratulatory telegrams. On this occasion he modestly affirmed that the good things that had come to him were through the kindness of his friends, and mentioned particularly the incident of

Dr. Metcalfe sending him South to his family, and Dr. Mitchell's offer of an association. He did not have to point out the lovable personal qualities that inspired such acts of kindness.

Dr. Maury was twice married. His first wife was Miss Jennie Ellett, who died in 1875. His second wife, who was Miss Jennie Poston, survives him, as do one daughter and five sons and numerous grandchildren and great-grandchildren.

Dr. Maury was a man of singular beauty of face, and those who knew him well saw reflected in it all the kindness and greatness of the man. Not physically robust, he was capable of much effort, not only in the way of fishing and hunting trips, which he greatly enjoyed, but for many years he withstood the arduous labors of a large general practice, which he was enabled to do by a careful and regular manner of living. He was beloved, admired and respected by all who knew him. His interests and activities touched many phases of life, both public and professional. He was for many years professor of gynecology in the Memphis Hospital Medical College, and in days when professional animosities were common and bitter he commanded the respect of all his colleagues. About one month before his final illness he was elected senior warden of Calvary Church for life.

His contributions to professional literature were not numerous, but scholarly. Some thirty-seven articles in journals and the chapter on "Periuterine Inflammation" in *Mann's System of Gynecology* remain as evidence of his literary activities. He was president of the American Gynecological Society in 1906 and one of the largest of the Memphis Public Schools is named for him. In 1888 he became a Fellow and in 1902 an Honorary Fellow of the Southern Surgical and Gynecological Association.

Dr. Maury died March 17, 1919, of pneumonia after an illness of one month. E. C. E.

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